Expert Witness Statement of James Weidmann

In the matter of the Fingerboards Mineral Sand Project EES – Flooding and Hydraulics

Kalbar Operations Pty Ltd

January 2021

1 INTRODUCTION

I, James Weidmann, was engaged by Kalbar Operations Pty Ltd (**Kalbar**) to prepare a witness statement and give evidence in respect to hydraulics and flooding for the proposed Fingerboards Mineral Sands Mine. I conducted a site inspection on the 9th to 10th of December 2020 to visually assess the site and surrounds.

Statement of Engagement, Qualifications and Experience:

- I have prepared this Witness Statement at the request of Kalbar.
- I am a Senior Water Engineer (Flooding and Hydraulics) at Water Technology Pty. Ltd. I hold a bachelor's degree in Environmental Engineering (University of Queensland), a graduate diploma in Environmental Management (University of Queensland) and I have 8 years' experience in engineering consultancy.
- A copy of my curriculum vitae is provided in Appendix A of this report.
- This statement is prepared as an independent and impartial report.
- I accept that I have an overriding duty to the Inquiry and Advisory Committee to assist impartially on matters relevant to my area of expertise, that my paramount duty is to the Inquiry and Advisory Committee and not to any party to the proceedings (including the entity retaining me), and that I am not an advocate for any party.
- I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Committee.

2 SCOPE

2.1 Role in Preparation of the EES

Water Technology has prepared the following reports to support the proposed mine application, which considered the hydraulics and flooding aspects of the Fingerboards Project:

- "Fingerboards Mineral Sands, Surface Water Assessment – Site Study", dated 30 April, ref: 6319-01_R01V08 (Water Technology 2020a), included in Appendix A006 (Appendix E) of the EES (**Site Study Report**); and
- "Fingerboards Mineral Sands, Surface Water Assessment – Regional Study", dated 30 April, ref: 6319-01_R02V09_Regional (Water Technology 2020a), included in Appendix A006 (Appendix F) of the EES (**Regional Study Report**).

The above reports were prepared by Water Technology under the direction of Simon Hof. Simon left Water Technology in November 2020. Since Simon left Water Technology, I have undertaken a detailed review of the flooding and hydraulic modelling aspects of the assessments undertaken and reviewed EES submissions that raised hydraulics and flooding matters. I am not qualified to comment on, and my statement does not address, the water quality matters addressed in the two Water Technology reports listed above.

The flood modelling undertaken by Water Technology addresses the ESS scoping requirements. I have undertaken additional flood modelling to address numerous submissions relating to flooding, as described in Section 3.3 of this statement. This additional flood modelling has informed assessments relating to potential erosion, sedimentation and landform stability effects of the project undertaken by my colleague, Dr Michael Cheetham.

2.2 Other Persons Who Assisted

The following people assisted me in preparing this statement:

Simon Hoff, Senior Engineer (BEng): Project Manager and contributor to hydrological and hydraulics components of the studies. His work contributed to the Site and Regional Reports noted above. Prior to Simon leaving Water Technology in November 2020, Simon helped me during the handover period to understand the assessments undertaken and provided advice for addressing some of the submissions.

Chris Delaney, Engineer (BEng): Chris contributed to the hydrology and hydraulics components of the study under the supervision of Simon Hoff. Chris assisted me in my detailed review of the hydraulic modelling.

2.3 Instructions

Instructions given to me to prepare this statement are included in Appendix B.

2.4 Methodology

The flooding assessment undertaken by Water Technology in the Site Study Report and Regional Study Report involved the following:

- Construction of a detailed hydraulic model (TUFLOW) encompassing the site and surrounding catchments;
- Application of a rain-on-grid (direct rainfall) modelling approach utilising rainfall data obtained from the Bureau of Meteorology (BoM) and ARR Datahub;
- Development of a hydrology model (RORB) to represent external catchment inflow for a portion of the Moilun Creek catchment;
- Hydrology from the Mitchell River Regional Flood Study (DELWP) was used to represent concurrent flow in Mitchell system (10% AEP event);
- Testing of existing conditions hydrologic regime including:
  - Additional event durations trialled including 1hr, 1.5hr, 2hr, 6hr, 12hr and 72hr.
  - All ten temporal patterns were tested (using the 1hr duration) to identify the catchments mean temporal pattern (as recommended in ARR2016).
- Literature review into appropriate model parameters / arrangements including:
  - Losses (initial loss / continuing loss).
  - Landform roughness.
  - Methodologies to represent controlled discharge/ proposed diversions.
- Empirical flow estimates and other regional comparisons calculated to test/validate model parameters (initial loss / continuing loss), confirming that the hydraulic model produces representative catchment flows.
- Hydraulic simulation of an extremely rare, worse-case scenario where all water management dams are full (ready to spill) and a 1% AEP 60-minute storm occurs. This was undertaken to examine changes to flows resulting from rare, high-magnitude events and assess the impacts of spillway releases;
- Hydraulic assessment of three (3) mine operations and one (1) post-mining rehabilitation scenarios, these being:
  - Year 5 of mining operations.

- Year 8 of mining operations.
- Year 15 of mining operations.
- Rehabilitation scenario.

Additional details of the flood assessment and modelling methodology are contained in the Site Study Report and Regional Study Report. I have undertaken additional hydraulic modelling to respond to submissions, the details of which are contained in Section 3.3 of this document.

The key assumptions made in preparing the flooding assessments include:

- Hydraulic modelling is based on available topographic LiDAR data captured in 2015 and 2018/19 which may vary from current site conditions. This is a typical caveat for all flooding assessments. Differences are likely to be localised and not have any significant effect on the outcomes of the assessment.
- Hydraulic modelling undertaken as part of the assessment is based on design surfaces provided by others.
- Water management dams were assumed to be 100% full ("upset operations") at the start of the hydraulic simulations. This is a highly conservative assumption and actual flooding impacts are likely to be less in reality.
- Several on-site stormwater diversions have been included in the mine operations scenarios which are conceptual in nature and will be subject to future detailed design assessment.
- The post-mining landform provided by Kalbar is conceptual and details such as specific watercourse paths and grading will be included in the mine closure planning stage.
- The assessments undertaken are preliminary in nature and are intended to inform the flooding and stormwater management approaches during operation and rehabilitation. The preliminary nature of the assessment models snapshots in time during the mine life. In reality, mining activities and landform changes will be dynamic, therefore, mitigation strategies will need to be continually implemented and adapted to suit the changing landforms and drainage arrangements. Additional detailed assessment should be undertaken during subsequent stages of the design and operations to ensure that flooding impacts of the mine are effectively managed.

I note that although the assessment is preliminary in nature, it is very common to undertake this level of assessment at this stage of a project. The results of the modelling are broadly representative of the worst-case flooding impacts.

2.5 Limitations

The following limitations apply to the flooding assessment undertaken:

- Hydrology and hydraulic modelling has been undertaken in the absence of appropriate stream gauge records. Flows have been validated using alternate industry accepted methods.
- The results of the assessment are contingent on the accuracy of the LiDAR data provided.
- Hydraulic modelling undertaken as part of the assessment is based on design surfaces provided by others.
  - The design surfaces provided were adequate for the purpose of my assessment, however, I note that they contained some triangulation errors which I corrected in the model, and are inconsequential to the overall assessment and outcomes.
- All flooding assessments undertaken have not specifically included allowance for changes in climate as is often required for resources/infrastructure projects. I have addressed this aspect as part of my response to submissions in Section 3.13.3. Overall, the risk of climate change is small given the relatively short timeframe on the project.

3 FINDINGS

The following section summarises the outcomes of my detailed review of the Site and Regional Reports and flooding assessments undertaken. I also provide a summary of the overall outcomes of all work undertaken to address submission items relating to flooding, including the additional modelling that has been undertaken since EES exhibition.

3.1 Corrections and Clarifications

I adopt the hydraulic and flooding aspects of the two Water Technology reports listed in Section 2.1 of my statement as the basis of my evidence before the Inquiry and Advisory Committee, subject to the following specific corrections and clarifications:

- Typo in Table 2-1 of the Site Study Report (page 30 of Appendix E/0006) in the Post-Mining (bottom) row. The corrected values are presented below (highlighted in red) and are essentially identical to the previously reported figures. The minor error has no bearing on the conclusions of the assessment.

TABLE 3-1 WATER BALANCE RESULTS REVIEW RESULTS (OUTLET J – TRIBUTARY OF THE HONEYSUCKLE CREEK)

Scenario	Peak flow (ML/d)	Number of flow days*	% of time flowing	Total Volume (ML)	Difference Volume (ML)	% increase in volume	Average daily flow (ML/d)
Pre mining	187.8	11176	26%	32851			0.76
Yr 5	129.6	12463	29%	32843	-8	0%	0.76
Yr 8	129.6	12642	29%	37279	4428	13%	0.86
Yr 15	59.41	12436	29%	30067	-2783	-8%	0.70
Post Mining	~~187.8~~ **188.0**	~~11176~~ **11126**	26%	~~32851~~ **32853**	~~0~~ **+2**	0%	0.76

* based on a low flow threshold of 0.001ML/d

- Hydraulic model flow validation clarification (Section 4.1.6 of the Site Study Report)
  - Several checks were previously undertaken to validate the hydraulic model peak flow at Honeysuckle Creek, however, the 1% AEP (1 in 100-year ARI) median peak flow extracted from the model (37.7 m^3/s) was inadvertently taken from a different tributary with a very similar label (Perry Gully instead of Perry). The "correct" flow would have been 55.0 m^3/s, which is higher than the previous validation flow. This flow estimate is still within acceptable bounds and does not have any bearing on the modelling outcomes. The updated models were validated again as discussed in Section 3.3.2 below.
- Section 5.5.4 of the Site Study Report in respect to downstream impacts identified in the "rehabilitation" scenario states that "the increase in flow to this region [the Honeysuckle Creek tributary downstream of the site] is assumed to be due to changes in catchment boundaries". It is my opinion that the total catchment area is fundamentally identical to the existing case, and that impacts are instead largely attributable to the change in landform and land use.

3.2 Summary of Opinions

Conclusions in respect to the hydraulic assessment are presented in Section 7 of the Site Study Report. In my opinion, the key findings of the assessment as detailed in the report are:

- The hydraulic modelling outcomes as summarised in Table 3-2 below. Note that Table 3-2 is adapted and updated from Table 7-1 of the Site Study Report based on the outcomes of the additional assessment discussed herein. I've included the percentage change based on the maximum flood depth. The location of the waterways is shown in Figure 3-1 below.
- In respect to the "Year 5" scenario, downstream impacts are noted in Lucas Creek and the Unnamed Gully to the north of the site up to approximately 100mm and 260mm respectively. Associated velocity impacts are up to approximately 0.3m/s and 0.6m/s.
- In respect to the "Year 8" scenario, downstream impacts are noted in the Unnamed Gully to the north of the site up to approximately 220mm. Associated velocity impacts are up to approximately 0.5m/s. Minor localised impacts are noted in upper reaches of Lucas Creek.
- In respect to the "Year 15" scenario, downstream impacts are noted in Lucas Creek, Simpson Gully and the Unnamed Gully to the north of the site up to approximately 400mm, 360mm and 210mm respectively. Associated velocity impacts are up to approximately 0.2m/s, 0.4m/s and 0.5m/s.
- In respect to the "Rehabilitation" scenario, downstream impacts are noted in Lucas Creek, Simpson Gully and the Unnamed Gully to the north of the site up to approximately 170mm, 140mm and 220mm respectively. Associated velocity impacts are up to approximately 0.2m/s, 0.2m/s and 0.5m/s. Impacts up to approximately 200mm are also noted in Honeysuckle Creek downstream of the site with minor associated increases in velocity of approximately 0.1m/s.
- In all cases, changes are predominantly due to an adjustment of internal catchment boundaries within the mine, and partially attributable to the change in hydraulic roughness (land use). Changes to water level and velocity can be reduced with refinements to the design surfaces and internal drainage arrangements if practicable. It is typical for these changes and improvements to be made during the design process. Any residual impacts can be mitigated by revegetation and channel stabilisation works.
- In all cases, water level impacts noted can be mitigated as discussed below, but are nonetheless minor given the following:
  - Water level impacts are largely contained to existing flood constrained land;
  - Flooding impacts predominantly affect heavily modified and rural farmland, and do not affect freeboard provisions for any residential dwellings.
- The Site Study Report notes that all significant flood impacts can be managed/mitigated with design and or operational procedures.
- It is my opinion that all the impacts identified can be reduced through effective mitigation strategies and can be managed. Key flood mitigation strategies include the following:
  - Maintain the existing landforms and catchment boundaries as much as practicable. Limit significant modification of catchment boundaries and provide internal drainage/diversions to maintain existing points of discharge as much as practicable to minimise offsite impacts. This is particularly important for the Perry Gully catchment to minimise impacts to the unnamed gully to the west.
  - Operational measures which include drawing down dams to ensure freeboard is available to attenuate flood impacts.
  - Vegetation buffers to manage velocity and erosion.
  - Grade control structures to stabilise active erosion features (head cuts) outside the active mining extent.

  - Regular and ongoing inspections of drainage system (during and post mining) to identify emerging issues (e.g. bed instabilities).
  - In respect to the rehabilitation impacts, flooding impacts can be mitigated via modifying the post-mining landform design and extensive revegetation to maintain the existing catchment response as much as practicable. Dam 18 located on the tributary to Honeysuckle creek may be utilised as a detention basin (designed to blend into the natural environment), which would be capable of mitigating flood impacts downstream if such infrastructure is allowed to remain post-closure.
- With reference to the Mitigation Register (Attachment H to the EES), Kalbar has committed to additional management practices to minimise off-site flooding impacts, including the following:
  - (SW02) - The design and placement of infrastructure in the project area will consider potential for flow accumulation and increased flood risk, and associated prevention measures.
  - (SW34) Ephemeral drainage gullies will be revegetated in areas downstream of future mining activities prior to operations commencing to increase landscape stability and specifically mitigate:
    - Effects of a moderate increased flow velocity downstream of the mine operations and the final landform.
    - Potential effects of tunnel erosion downstream of the mine void boundary where soil treatment is not planned.
    - Effects of sediment starvation by reducing sediment transport and encouraging deposition.
- Landowners shown to be impacted by changes in flooding regime should be engaged through the broader EES and approvals process. Models developed as part of this study can be used to help understand the potential magnitude changes and the effectiveness of the surface water management system.
- The ongoing design of the rehabilitated landform should respond to the findings of this study. Adjustment to catchment boundaries and valley morphology is recommended during future design updates as well as careful management of valley arrangements including fill types and vegetation type and density. Future rehabilitation designs should include the input of a qualified geomorphologist. The hydraulic model developed in this study (or similar) should be used as an evaluation tool for future designs.

TABLE 3-2 FLOOD IMPACT RESULTS

Mine Year / Stage	Identified changes					
	Lucas Creek	Simpson Gully	Perry Gully	Long Marsh Gully	Honeysuckle Creek	Unnamed Gully
Year 5	Flood level increases up to 100mm (20%)	Reduction in flooding	Reduction in flooding	Reduction in flooding	Reduction in flooding	Flood level increases up to 260mm (20%)
Year 8	Flood level increases up to 50mm (60%)	Reduction in flooding	Reduction in flooding	Reduction in flooding	Reduction in flooding	Flood level increases up to 220mm (16%)
Year 15	Flood level increases up to 400mm (11%)	Flood level increases up to 360mm (17%)	Reduction in flooding	Reduction in flooding	Reduction in flooding	Flood level increases up to 210mm (15%)

	Identified changes					
Rehabilitation	Flood level increases up to 170mm (5%)	Flood level increases up to 140mm (7%)	Reduction in flooding	Reduction in flooding	Flood level increases up to 200mm (10%)	Flood level increases up to 220mm (16%)

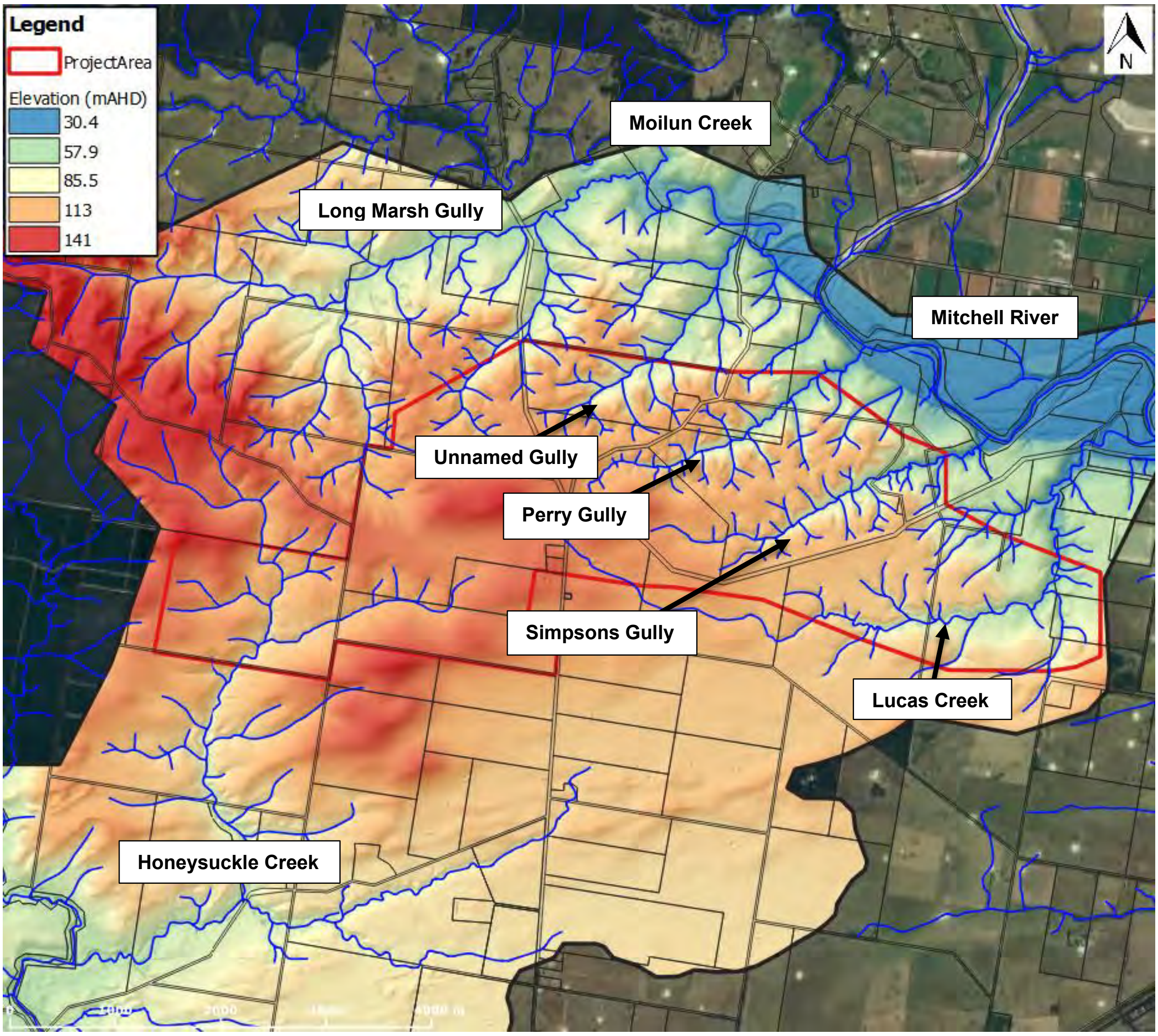

FIGURE 3-1 PROJECT AREA WATERWAYS

3.3 Additional Work Undertaken Since Preparation of the Reports

3.3.1 Purpose of the Additional Modelling

A number of ESS submitters expressed concerns about flooding impacts to the Perry River. As such, I have undertaken additional modelling to assess potential impacts to the Perry River system. Specifically, this involved building a new RORB hydrology model for the Upper Perry River to provide inflows for the extended TUFLOW model which was also updated and extended to include the Perry River. Details of the additional modelling undertaken are contained in the following sections. Collectively, the results of the additional modelling undertaken are discussed in Section 3.3.4.

Some ESS submitters also raised concerns over flooding impacts to the Mitchell River. This has been addressed with additional discussion as detailed in Section 3.3.5.

3.3.2 Upper Perry River RORB Modelling

To assess the impacts of the proposed mine on flooding conditions in Honeysuckle Creek and the Perry River, it was necessary to develop a hydrology model for the Upper Perry catchment. The purpose of the model is to inform the Perry River impact assessment and provide regional hydrographs (inflows) for the hydraulic model as discussed separately in the following section.

Modelling the entire Perry catchment to Lake Wellington is not necessary, given that if no impacts are identifiable downstream of the Honeysuckle and Perry confluence, it can be assumed that areas farther downstream will not be affected. The model outlet was positioned approximately 5.8km downstream of the Honeysuckle and Perry confluence, and the upstream catchment was divided into approximately 64 sub-catchments of roughly similar size. The recently available 2018/2019 LiDAR for the Perry catchment was utilised for catchment delineation. Figure 3-2 shows the RORB model layout.

Model parameters were adapted and scaled from the Mitchell River RORB model (developed by Water Technology) which is a calibrated hydrology model for a neighbouring catchment. All impervious percentages were assumed to be effectively zero. The model utilises standard ARR19 design losses and rainfall parameters, which is consistent with the previous modelling for the site.

Flows were validated using the RFFE online tool for the outlets of sub-catchments “1.17” and “15.03”. The comparison shown in Table 3-3 demonstrates that the 1% AEP (1 in 100-year ARI) flows are reasonable (noting that the upper confidence limit for sub-catchment “1.17” is 594 m^3/s).

The peak flow for sub-catchment “15.03” located downstream of the site was also validated using the Rational Method. The results demonstrate that flows from the Honeysuckle Creek tributary catchment which contains the western part of the mine site are reasonable. We note that the calculation was somewhat sensitive to the adopted C_{10} value and assumed velocity, however, the adopted values are reasonable based on-site inspection observations and hydraulic modelling results. The calculation is also constrained for catchments that have two similarly sized sub-catchments converging at the validation location (“15.01” and “16.01” below). In reality, flows from the two catchments will converge at similar times, resulting in higher peak flows than can be estimated using the Rational Method. The resulting Rational Method flow estimate will therefore be an underestimate. Indeed, the hydraulic model predicts the median 1% AEP (1 in 100-year ARI) flow at the sub-catchment “15.03” location to be 61.6 m^3/s.

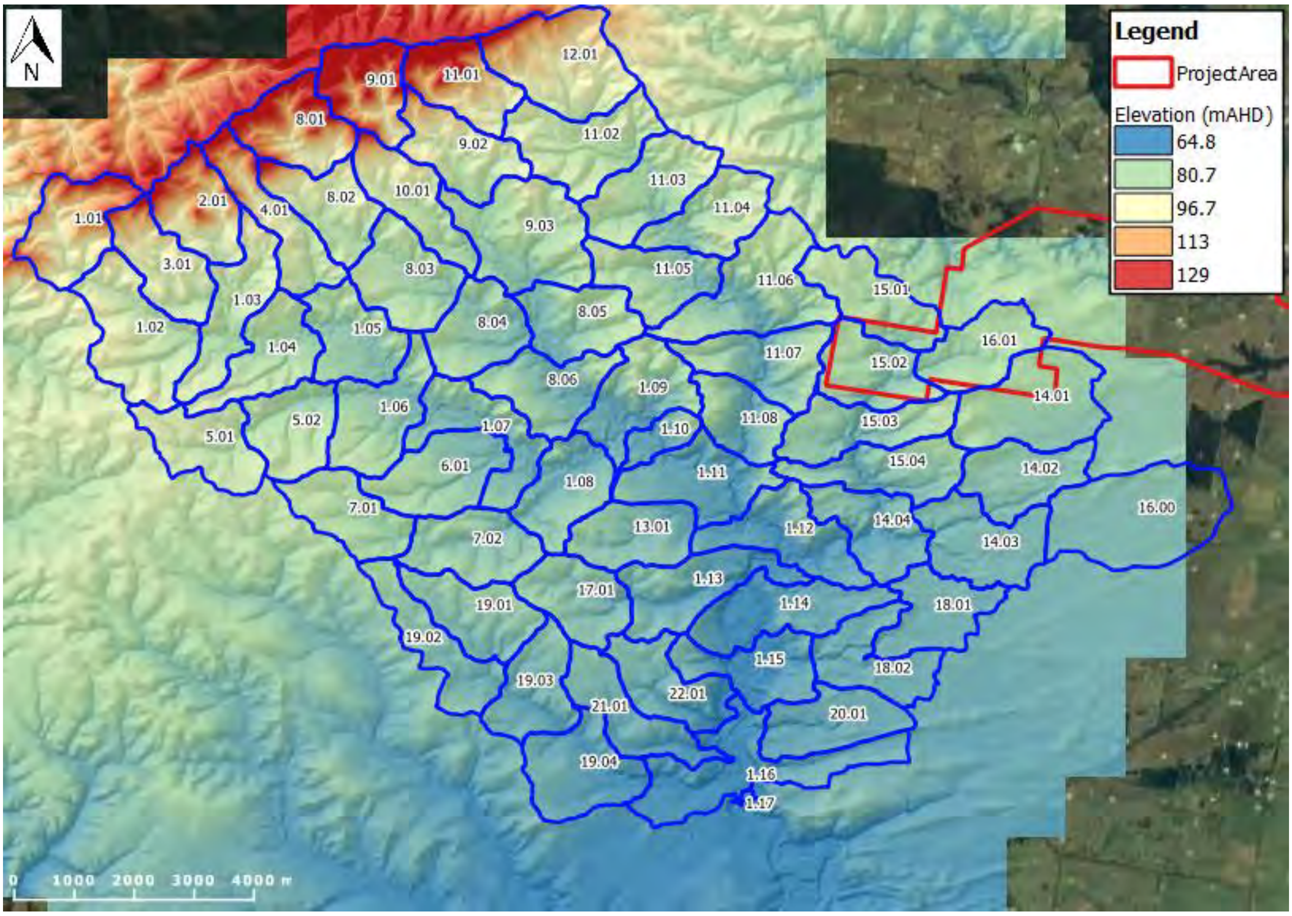

FIGURE 3-2 UPPER PERRY RORB MODEL LAYOUT

TABLE 3-3 RFFE FLOW VALIDATION SUMMARY

Parameter	Sub-catchment 1.17	Sub-catchment 15.03
Total upstream area (km^2)	145.3	8.37
RORB 1% AEP median peak flow (m^3/s)	435	50.2
RFFE 1% AEP discharge	259	47.3

TABLE 3-4 RATIONAL METHOD FLOW VALIDATION SUMMARY

Parameter	Sub-catchment 15.03
Total upstream area (km^2)	8.37
C_{10}	0.46
Flowpath Length (m)	4,830
Channel Velocity (m/s)	0.7
Overland Flow Time (mins)	115
Rational 1% AEP Discharge (m^3/s)	44.5
RORB 1% AEP median peak flow (m^3/s)	50.2
Percentage Difference	+11%

3.3.3 Additional TUFLOW Hydraulic Modelling

The previous hydraulic model extent included the entire project site, a section of the Mitchell River, a section of Moilun Creek, Long Marsh Gully, and a section of Honeysuckle Creek. Upstream boundary conditions were included which represented hydrographs (inflows) for the greater Mitchell River and Moilun Creek catchments. I am satisfied that the previous modelling work demonstrates that the project will not have any adverse impact on flooding or flood behaviour in the Mitchell River and therefore does not require any additional assessment.

In respect to Honeysuckle Creek, it was not clear how far downstream potential impacts in the rehabilitation scenario may extend or whether flood impacts may be present in the Perry River located approximately 4.5 kms downstream of the project site. The location of the previous model downstream boundary on Honeysuckle Creek was constrained by the lack of 1m LiDAR data any further downstream. However, since the completion of the previous modelling work, additional LiDAR data has been released which includes the entire Perry River catchment (understood to be captured in 2018 and 2019). The additional LiDAR has been used to supplement the previous datasets and extend the hydraulic model to approximately 5 km downstream of the Perry River and Honeysuckle Creek confluence. This is a sufficient distance from the confluence to adequately assess impacts to the Perry River.

Changes and improvements to the existing case hydraulic model are summarised as follows:

- Inclusion of the additional 1m LiDAR for the Perry River (captured in 2018/19).
- Extension of the model boundaries to include additional catchments to the south of the site.
- Updated downstream boundary located approximately 5 km downstream of the Perry River and Honeysuckle Creek confluence.
- Inclusion of regional upstream inflows in the Perry River and California Creek based on the RORB model output.
- Adoption of depth-varying roughness parameters which more accurately represent flow in on rain-on-grid model.
- Adoption of the latest version of TUFLOW (Build 2020-10-AA).
- Application of a 5m grid size with the Sub-Grid-Sampling (SGS) enhancement (sampling the LiDAR DEMs at 1m).

The existing case model topography is based primarily on the available LiDAR datasets for the catchment. The model layout is shown in Figure 3-3. Minor topographic modifications were required to ensure flow continuity and approximate some culvert crossings where details are not available.

The mining operation cases included the previously assessed “Year5”, “Year8”, “Year15” and “Rehabilitation” scenarios. The model set up is largely identical to the previous assessment, with only minor topographical modifications made to suit the updated cell resolution. I note that the design surfaces provided contained some triangulation errors which are inconsequential to the overall assessment and outcomes, but were nonetheless corrected as part of the updated modelling.

The “Rehabilitation” case materials layer was modified to suit the updated proposed revegetation layout shown in Figure 3-4.

The hydraulic simulations concentrated on the 1% AEP (1 in 100-year ARI) and 50% AEP (1 in 1.44-year ARI) events only for the concept assessment.

For the 1% AEP (1 in 100-year ARI), all ten (10) temporal patterns for the 1-hr, 3-hr and 12-hr storms were simulated hydraulically for the existing case model. This selection was based on the critical durations in the RORB model at four (4) locations: immediately downstream of the site (sub-catchment 15.02), Honeysuckle Creek upstream of the Perry Confluence (sub-catchment 14.04), Perry River upstream of the Honeysuckle

Confluence (sub-catchment 1.11) and Perry River downstream of the Honeysuckle Confluence (sub-catchment 1.14).

For the 50% AEP (1 in 1.44-year ARI), all ten (10) temporal patterns for the 9-hr storm were simulated hydraulically for the existing case.

The results were processed to determine the critical temporal pattern for each duration. For the purpose of this preliminary assessment, and to minimise total computation time, only the critical temporal patterns were simulated to assess the “Year5”, “Year8”, “Year15” and “Rehabilitation” cases. Impact maps contained in Appendix C have been developed based on differences with the corresponding existing case duration and temporal pattern.

The hydraulic model 1% AEP (1 in 100-year ARI) median flow for the sub-catchment “1.15” outlet location (shown below) was compared to ensure consistency with the RORB model. The critical 1% AEP 12-hr duration median flow is 363 m^3/s, compared with 409 m^3/s in the RORB model. Flows in the hydraulic model are expected to be lower in the hydraulic model compared to the hydrology model largely due to the storages present in the hydraulic model (such as natural channel storage, depressions and farm dams) that are not replicated in the RORB model.

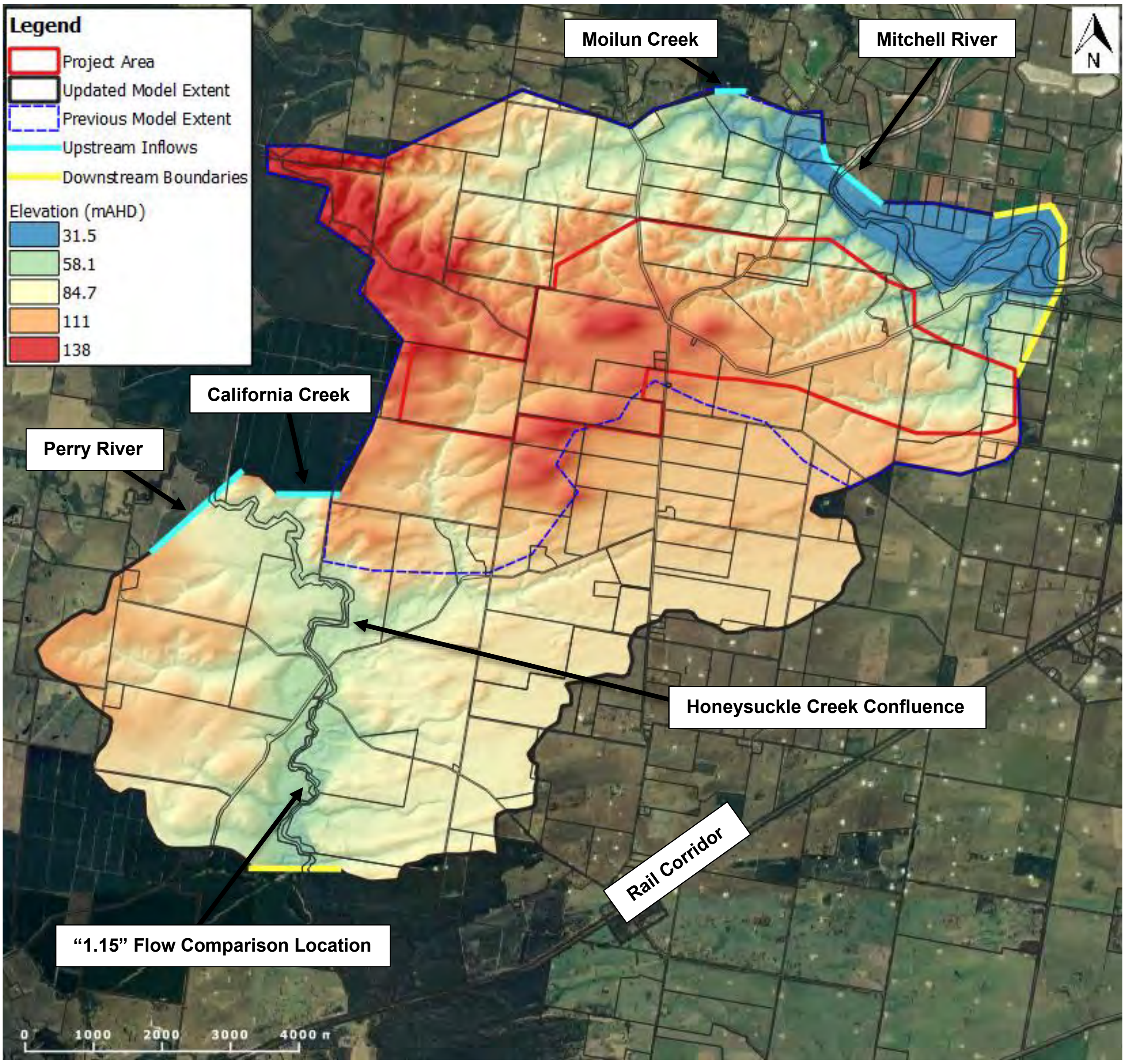

FIGURE 3-3 UPDATED TUFLOW MODEL LAYOUT

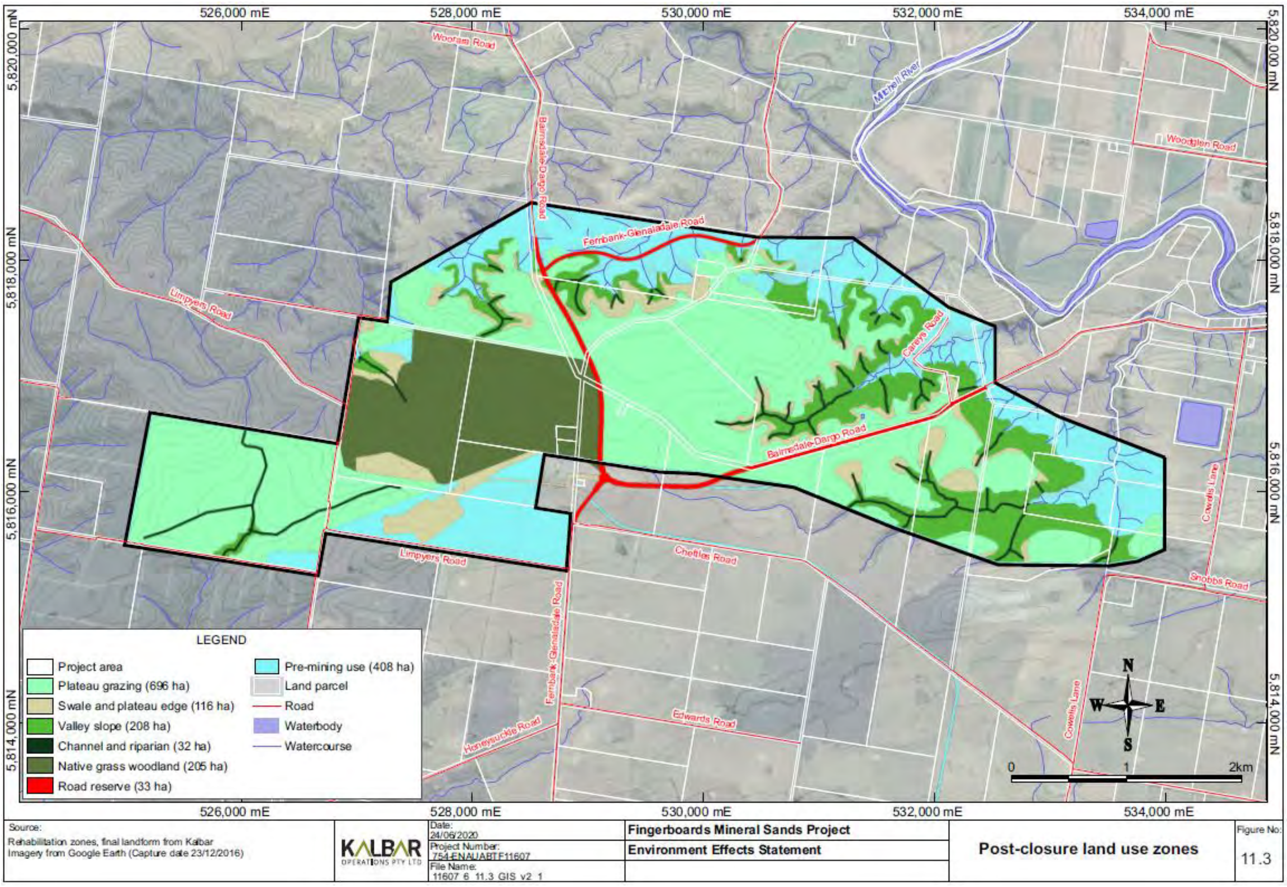

FIGURE 3-4 REHABILITATION LAND USE LAYOUT (KALBAR 2020)

3.3.4 Additional Modelling Results

Flood impact mapping is contained in Appendix C. The results are largely consistent with the previous modelling. Differences can be attributed to the model changes discussed above, and particularly the adoption of the latest TUFLOW version and Sub-Grid-Sampling enhancement. Note that the water level impact mapping will look different to the previous mapping due to a change in output settings (map cut-off depth) but are both derived the same way. The change in output settings was necessary given the fundamental difference in the way the latest TUFLOW version is configured and solves hydraulic equations.

Hydrographs were extracted from the hydraulic model for two locations downstream for the site shown in Figure 3-5 below. Figure 3-6 shows the 1% AEP (1 in 100-year ARI) 12-hr event for the existing and post-rehabilitation (having the highest impact) cases. Figure 3-7 shows the 1% AEP (1 in 100-year ARI) 1-hr event for the same scenarios. Impacts do not propagate downstream of the Honeysuckle Creek and Perry River confluence by virtue of the much larger external catchment of the Perry River.

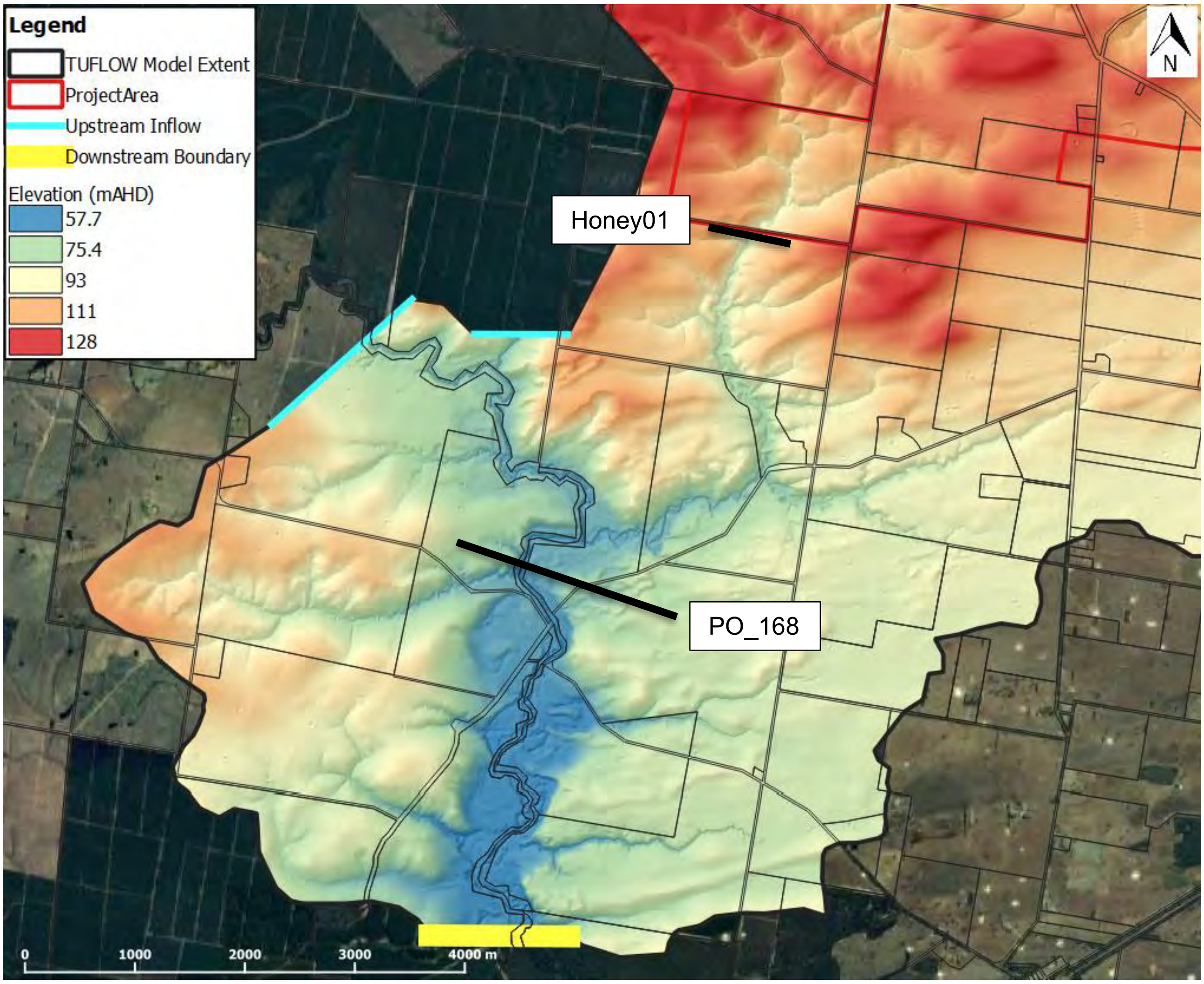

FIGURE 3-5 HYDROGRAPH LOCATIONS

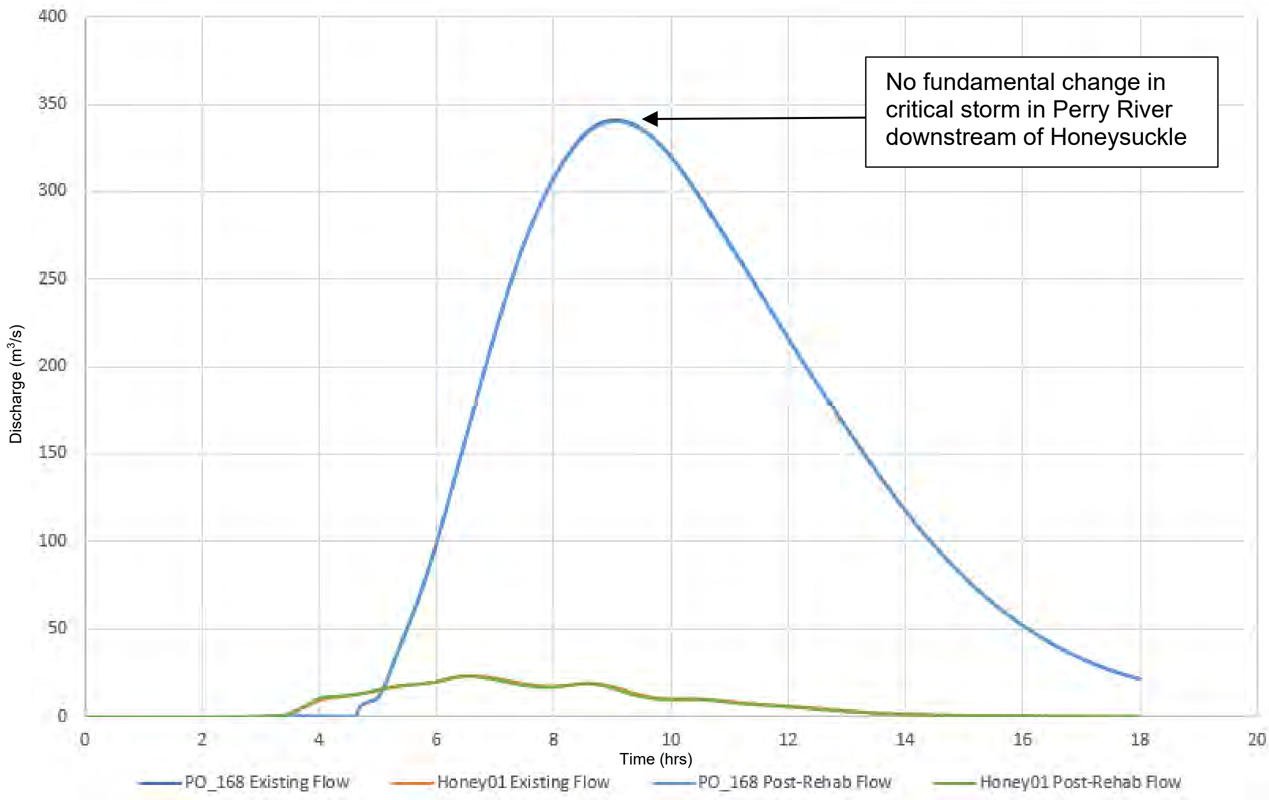

FIGURE 3-6 1% AEP 12-HOUR CRITICAL STORM HYDROGRAPHS

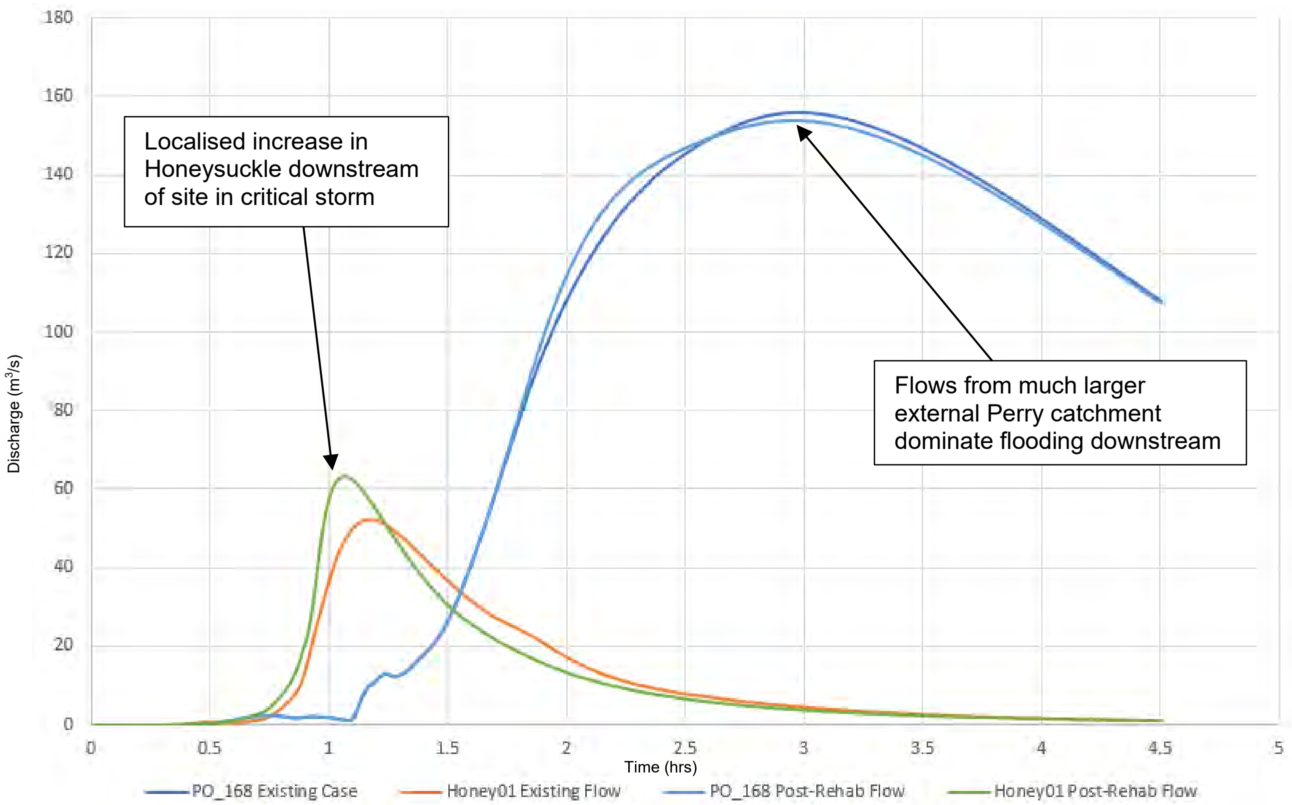

FIGURE 3-7 1% AEP 1-HOUR CRITICAL STORM HYDROGRAPHS

3.3.5 Impacts to Mitchell River

The flooding assessment in the Site Study Report demonstrated that the mine operations would not have any adverse flooding impacts on the Mitchell River - refer to the flood mapping contained in Appendices B, C, D and E of the report. Impacts were identified in local tributaries, however, no adverse impacts are predicted in the Mitchell River by virtue of the much larger external catchment to the north which dominates flood conditions in the Mitchell River. Impacts will therefore not propagate to the lakes downstream.

Figure 3-8 below shows a comparison of the Mitchell River 10% AEP flows and flows from selected site tributaries in a co-incident 1% AEP event. The hydrographs demonstrate that the much larger external catchment of the Mitchell River dominates flood conditions downstream of the site. Note that the regional flows shown are for a 10% AEP event and a co-incident 1% AEP would result in significantly higher flows.

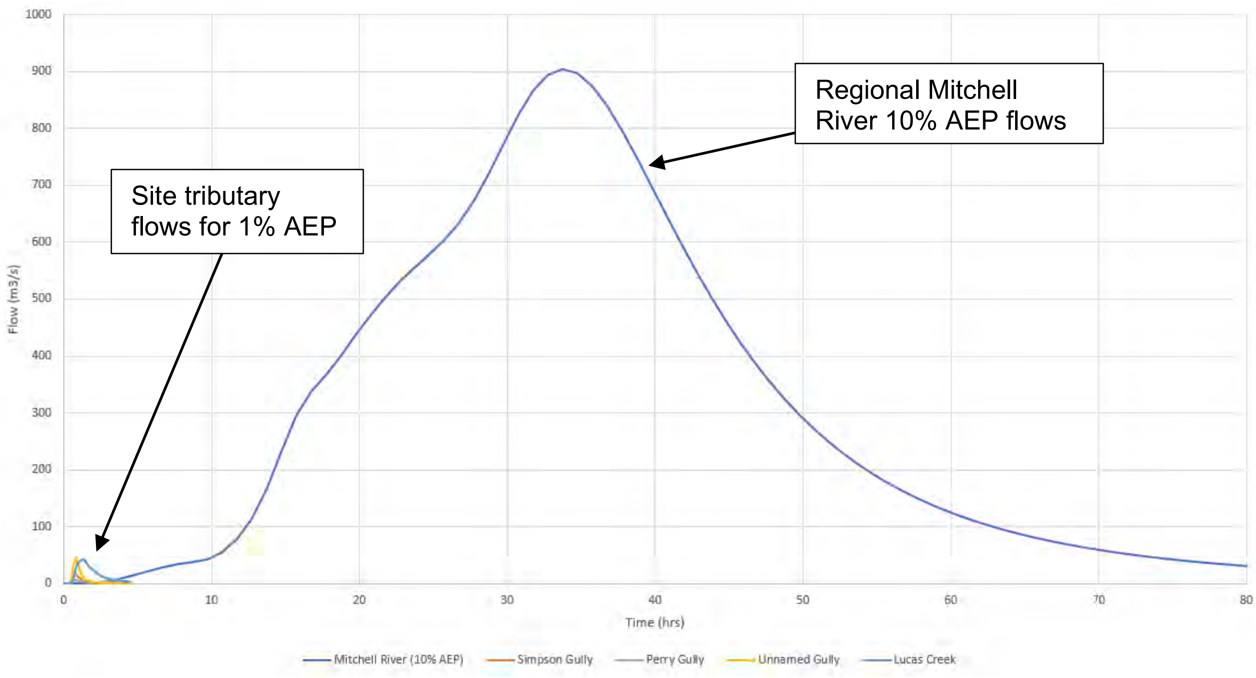

FIGURE 3-8 REGIONAL VS SITE TRIBUTARY FLOWS

3.4 Response to Submissions

I reviewed submissions with comments relevant to my field of expertise. Table 3-5 contains submissions which include substantial content relating to my area of expertise. I have provided a response to each of the submissions separately below. Table 3-6 contains submissions which provide general comments or concerns relating to my area of expertise. The general concerns tend to be common to many submissions, therefore, I have provided a response to these recurring general concerns separately in Section 3.13. I note that many other submissions mention “water” or “rainfall” but are not substantive in terms of flooding. I have not included these in the lists below.

I have also considered and support Kalbar’s responses to a number of the IAC questions dated 11 December 2020. My responses to those questions are set out in Section 3.12.

TABLE 3-5 SUBMISSIONS WITH SUBSTANTIAL CONTENT RELATING TO MY FIELD OF EXPERTISE

#	Title
716	Environmental Effects Statement, Draft East Gippsland Planning Scheme Amendment C156 and EPA Works Approval Application – Fingerboards Mineral Sands Project, Fingerboards and Glenaladale
358	Fingerboards Mineral Sands Project Inquiry and Advisory Committee
268	Submission into the EES assessment for the proposed Mineral Sands Mine at Glenaladale
429	Submission by Bendigo District Environment Council to the Kalbar EES. 2020.
568	My Submission into the EES for the Proposed Mineral Sands Mine at Glenaladale.
812	EES Submission (Coleman Partnership)

TABLE 3-6 SUBMISSIONS WITH RECURRING GENERAL CONTENT RELATING TO MY FIELD OF EXPERTISE

Recurring General Issues Raised	Submission #
Potential flooding impacts of dam failure.	70, 155, 191, 201, 239, 291, 524, 673, 713, 843
Extreme rainfall and east coast lows have not been considered.	70, 123, 135, 155, 168, 191, 201, 239, 524, 530, 673, 712, 713, 837, 843, 866, 875, 896
Climate change impacts on flooding.	691, 813

3.5 Response to Submission #716

This submission requests an explanation of the supposed 3% Average Exceedance Probability (AEP) Mitchell River spillway discharge design criteria. The submission states that “the water balance predicted 3 overflow events during a 117-simulation period which corresponds to a 2.5% AEP event and a 37.5% probability that a mine water discharge event will occur during the 15-year project life.”

It is correct that 3 overflows during a 117-year period corresponds to 2.5% AEP, however, the probability of this occurring over a 15-year period is 32%, and not 37.5%. In any case, the mine contact and process water dams have been sized to contain the volume of the 1% AEP (1 in 100-year ARI) 72hr storm. This storm event was selected because it is representative of a storm event caused by an ‘east coast low’. Based on the water balance modelling undertaken by EMM, the dams are predicted to spill less than once in 30 years (which roughly equates to a 3.3% AEP, (1 in 30-year ARI)). This is because the dams are unlikely to be empty prior to a significant rainfall event. The 1% AEP 72hr design specification only refers to the volume available (containment capacity) and does not refer to the spillway design, which is typically designed to pass 0.1% AEP (1 in 1000-year ARI) flows or higher, depending on the outcomes of a risk assessment to be undertaken at detailed design.

3.6 Response to Submission #358

Under the heading, “Change in flow regime”, this submitter contends that whereas Section 7.6.3 of Appendix A006 to the EES identifies an increase in the Perry River catchment discharges by 13%, the Regional Study Report states a reduction in flows in the “Year 8” scenario. I am not able to find where it says this and believe it may be based on a misinterpretation of the flood modelling results. According to the Regional Site Report, “Modelling of existing conditions and mine development showed that runoff to the Perry River will increase with mine operation. The increase reaches a maximum of 13% in the 8-year mining scenario for the small upstream site catchments - which subsequently causes a 1.05% increase in the average annual runoff volume in the Perry River.”

Under the heading, “Flooding” it is claimed:

- The change in topography following mine rehabilitation will increase the catchment boundary and watershed of the Honeysuckle creek catchment.
- Modelling indicates that peak flows in the waterway downstream of the mine boundary will increase by 12.2m^3/s, which equates to a 20% increase.
- Increased flood levels of 100 to 200mm downstream of the mine area and did not assess impacts further downstream or to Perry River

As stated previously in this document, I do not agree that that the change in overall catchment area contributes significantly to the impacts noted downstream in Honeysuckle Creek in the rehabilitation case. The overall Honeysuckle Creek catchment will not be changed significantly. The impacts noted downstream are predominantly attributable to the internal landform and land-use changes. Both these aspects of the design and rehabilitation strategy can be refined and managed such that impacts are mitigated.

I have recommended that mitigation strategies be implemented to minimise offsite impacts. Nonetheless, it is my opinion that water level impacts identified as part of this assessment are minor given that they are largely contained to existing flood constrained land and predominantly affect heavily modified and rural farmland, and do not affect freeboard provisions for any residential dwellings.

The results stated above by the submitter are consistent with the updated modelling; however, these impacts are overstated given the conservative nature of the assessment (assuming water management dams are full), and additionally noting that impacts can be mitigated with subsequent design phases and assessments.

In respect to impacts to the Perry River, this has been addressed as part of the additional assessment undertaken since the preparation of the Site Study Report. Results are detailed in Section 3.3.4 of this document. The results demonstrate that impacts will not propagate further downstream than the Perry River confluence, including to Lake Wellington.

3.7 Response to Submission #268

This submitter claims that there is no flood data or modelling for the site. This is incorrect. All details of the methodology and outcomes of the flood assessment undertaken has been detailed in the Site Study Report, and additional flood modelling has been undertaken as detailed in Section 3.3 of this document.

The submitter also claims that rainfall totals up to 254mm in 24hrs are possible for the site.

According to BoM IFDs, rainfall of 254mm in 24hrs equates to approximately a 0.1% AEP (1 in 1000-year ARI) event. This amount of rainfall is possible, but is very unlikely, and far exceeds the usually adopted standard design event threshold for the design of most structures (generally the 1% AEP event). Depending on the outcome of the dam safety assessments to be completed at the detailed design stage, dam spillways may be designed to convey up to 0.1% AEP (1 in 1000-year ARI) flows.

I also note that according to the EMM Conceptual Surface Water Management Strategy and Water Balance Report (Appendix A006 (Appendix A) of the EES), the highest recorded daily rainfall total (in 117-years of data) is 206mm.

3.8 Response to Submission #429

This submitter raises concerns regarding the potential for dam failure. I have provided a response to all submissions which contain references to dam failure in Section 3.13.2 below.

The submitter also alleges that Water Technology has not provided hydrological models for flooding events. Details of the hydrological modelling undertaken for the Fingerboards are contained in the Site Study Report, and in Section 3.3 of this document.

3.9 Response to Submission #568

Under the heading "Water/Rainfall not accurate", this submitter claims that rainfall measured at the Fingerboards site very rarely matches gauges at Mt Moornapa, Lindenow or Glenaladale. The submitter also claims that the BoM has no idea of the rainfall that falls on the Fingerboards plateau and that BoM's erroneous rainfall data will result in engineered structures not strong enough to withstand a 1-in-100-year weather event or extreme events. The submission presents examples of varying rainfall from two time periods (July 2020 and June-Dec 2007) claiming Fingerboards receives approximately 20% more rainfall than at his residence.

The submitter's concerns may be grounded in some truth, in that micro-climates can exist and rainfall patterns can vary significantly over small distances. However, rainfall patterns tend to vary where there is significant topography or landform changes. The submitter's property is on the eastern fringes of the site, located only 5 kms from the Fingerboards and the topography change is unlikely to be a contributor to the alleged rainfall differences. Rain gauges located 5kms apart will naturally vary and can sometime vary significantly over short time periods. The rain gauge differences noted in the submission are likely due to erroneous measurements. Additionally, measurements from only two time periods is not enough to draw any significant conclusions regarding spatial rainfall distribution.

The submitter's assertions are also not supported by AWAP (Australian Water Availability Project) gridded rainfall data, which comprises high-resolution daily rainfall gridded datasets from 1900 onwards. The dataset is derived by analysing thousands of rain gauges to produce an interpolated rainfall depth surface (or grid) covering the whole of Australia. The same datasets are used to derive IFD curves used for design event modelling undertaken as part of this project and which will be used to inform future detailed design. The resolution of the dataset (5km x 5km) is very high considering its spatial coverage, however, it is limited in detecting micro-climates if local rain gauges are present to capture this variability. Nonetheless, according to the AWAP data, 630mm of rain fell over the Fingerboards area for the June-December 2007 period. This compares to 687.5mm and 412.5mm measured by the submitter at Fingerboards and his residence respectively. Although the AWAP data is slightly lower, this indicates that the AWAP data (and by extension the adopted design rainfall depths) appropriately represent rainfall total for the Fingerboards area and that the measurement taken on the submitter's property is likely to be erroneous. AWAP does not contain data for 2020.

The SILO Gridded Rainfall dataset[1] is also derived using the rainfall data relied upon for the IFD calculations. This dataset is similar to the AWAP data, but derived using different techniques. According to the SILO data, 668mm fell the Fingerboards between June-December 2007. SILO data also suggests 131mm fell over the shorter time period of July 2020, which is similar to the 136mm measured by Mr Johnson on his property, but lower than the 175 measured at the Fingerboards. More variability will naturally occur over shorter timeframes, and the measured difference is not sufficient justification to adopt increased IFDs to inform future designs.

The comparisons with the AWAP and SILO rainfall datasets confirms that the rainfall data relied upon for the project (specifically the IFD rainfall depths) is appropriate for the site.

Under the heading "Water and Flood Gauges Future 1-in-100-year events", Mr Johnson questions whether the impacts on his property and in the Mitchell River floodplain are appropriately representing actual impacts.

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[1] Jeffrey, S.J., Carter, J.O., Moodie, K.B. and Beswick, A.R. (2001). **Using spatial interpolation to construct a comprehensive archive of Australian climate data**, Environmental Modelling and Software, Vol 16/4, pp 309-330. DOI: 10.1016/S1364-8152(01)00008-1.

Hydrologic and hydraulic modelling undertaken as part of my assessments confirms that any flooding impacts caused by the mine will be contained onsite, or to tributaries downstream. Results in respect to impacts on the Mitchell River are summarised in Section 3.3.5 of this document. Impacts do not affect the main Mitchell River channel by virtue of the much larger external Mitchell River catchment upstream of the site. The modelling utilises hydrology extracted from a calibrated model for the Mitchell River and is reliable and representative of flooding in the catchment.

The submission also questions why there isn't another dam capturing run-off from north and northeast of the processing/truck loading facilities. The submission claims this generates 1.5 times more run-off than that going to Dam 18. I am unable to discern how this claim has been arrived at. In any case, all mine contact water (including run-off from the processing and truck loading facilities) will be directed to water management dams.

On Page 12 of the submission, there is a photo with the label "Culvert following from tailing dam area estimated to flowing at 3gl per day in recent rain". It is unclear how the 3 GL per day figure has been estimated. However, if it is an estimate of the total flow at the culvert location shown in the photo, this is clearly in error as 3 GL in 24 hours (on average approximately 35,000 m^3/s) is an extremely large and unrealistic amount of flow in this instance. It is not clear where the culvert is located or what rainfall depths occurred, so I am unable to estimate the flow myself. However, the submitter's estimate is likely to be out be a factor of 1000 to 10,000.

3.10 Response to Submission #812

Under the heading "East Coast Lows", this submitter contends that east coast lows occur randomly, frequently and are a major risk. Rainfall at Fingerboards has been recorded as significantly higher than at properties 5kms away. I presume this submission is referring to the measurements referred to in Submission #568 – in which case, see my response to Submission #568 above.

The submission also asserts that dams must be constructed to the "new ANCOLD requirement of 1 in 1000-year event, rather than the 1 in 100-year flood events". The mine contact and process water dams have been sized to contain the volume of the 1% AEP (1 in 100-year ARI) 72hr storm. This storm event was selected because it is representative of a storm event caused by an 'east coast low'. Based on the water balance modelling undertaken by EMM, the dams are predicted to spill less than once in 30 years (which roughly equates to a 3.3% AEP, (1 in 30-year ARI)). This is because the dams are unlikely to be empty prior to a significant rainfall event. The 1% AEP 72hr design specification only refers to the volume available (containment capacity) and does not refer to the spillway design, which is typically designed to pass 0.1% AEP (1 in 1000-year ARI) flows or higher, depending on the outcomes of a risk assessment to be undertaken at detailed design.

Design of the water management and tailings dams are a civil design matter and will be designed in accordance with the latest ANCOLD guidance as specified in the Mitigation Register (Attachment H of the EES). Details can be provided when those structures undergo detailed design.

3.11 Response to Submission #813

This submission states that climate change is a major risk for the industry and its impact has not been adequately addressed. I have provided a response to all submissions which contain references to climate change and flooding in Section 3.13.3 below.

3.12 Response to IAC Request for Information

The IAC submission requests an explanation of the supposed 3% Average Exceedance Probability (AEP) Mitchell River spillway discharge design criteria and why this is different to the Perry River design criteria of

1% AEP, which is a more widely adopted design criteria for mine water runoff. Please refer to my previous response to Submission #716 in Section 3.5 above.

The IAC requests information on the indirect impacts of the railway siding on the wetland area including potential changes in the hydrological regime.

The preferred rail siding site (shown in Figure 3-9 below) is located outside of the available detailed (1m) LiDAR extents, so it is not possible to undertake a detailed hydraulic assessment at this stage. Shuttle Radar Topography Mission (SRTM) data is available as shown below, and is adequate for showing the approximate catchment contributing to Saplings Morass. To ensure that the hydrological regime of Saplings Morass is not affected by the proposed new rail corridor, several cross-drainage culverts will be required to preserve the existing flow regime as much as practicable. Indicative locations of the culverts are shown below, noting that the most southerly of these should be sized to cater for overflows from the morass.

The culverts (or bridge structures) can be designed to maintain exiting conveyance such that the existing water levels, duration of inundation and flow paths of the morass are not adversely impacted. Note that the majority of the morass catchment is not affected by the rail corridor.

The alignment of the preferred rail siding is parallel with and immediately upslope of the existing rail corridor, thus minimising potential impacts to stormwater runoff. The rail siding itself will not affect Saplings Morass. The minor catchment upstream of the rail siding can be readily managed with standard stormwater drainage and diversions to maintain the existing discharge points across the existing rail corridor to the immediate south.

Stormwater drainage for the proposed new rail corridor and siding are matters for detailed design, but it is my opinion that with standard detailed drainage design, neither will have any adverse hydrological impacts on Saplings Morass or impacts further downstream.

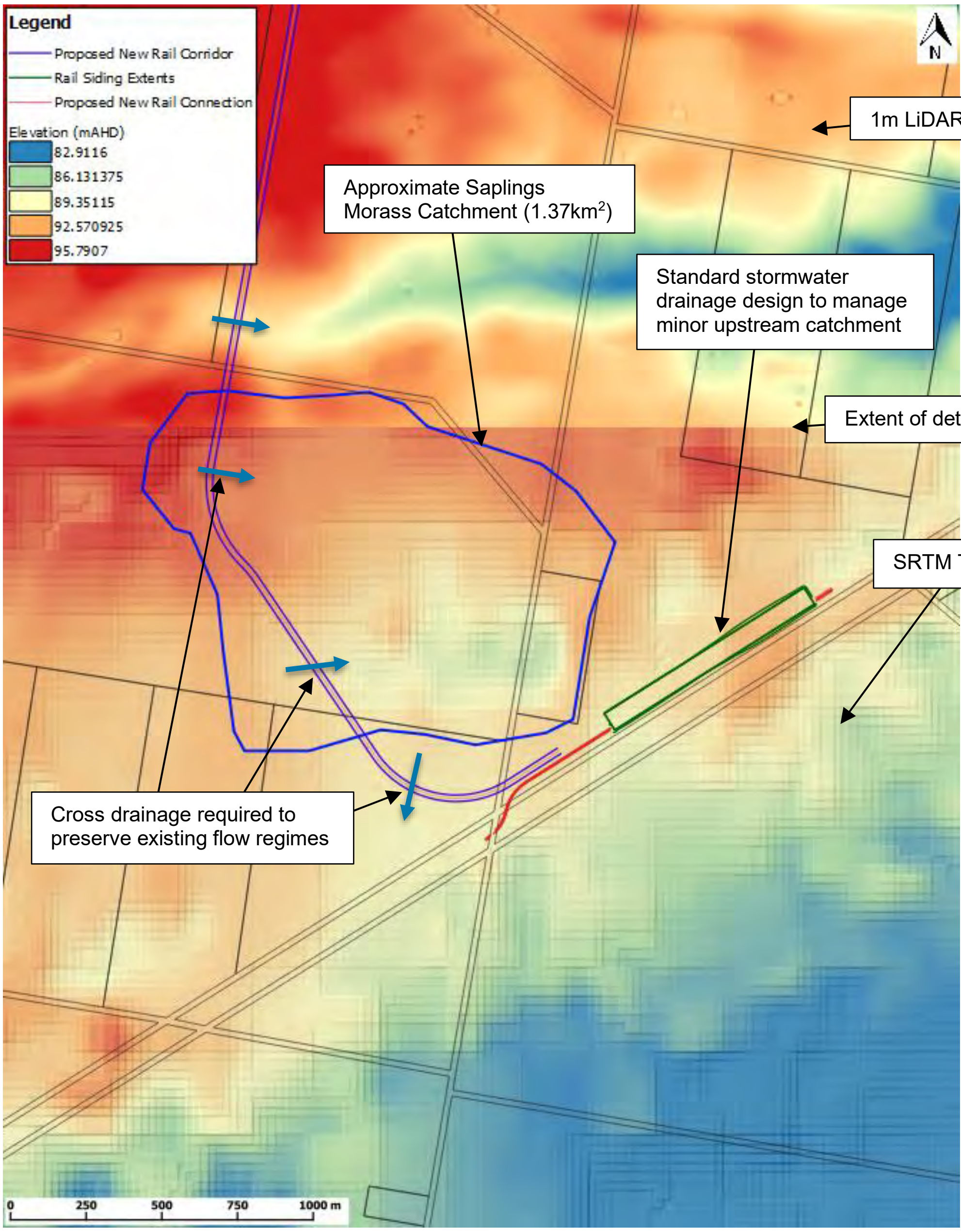

FIGURE 3-9 PREFERRED RAIL SIDING ALIGNMENT

The IAC requested information on flood modelling undertaken to demonstrate changes to flood level and impact on the catchment, private property, and public infrastructure, until discharge of surface water to Lake Wellington.

The flooding assessments undertaken demonstrate that the mine operations will not have any adverse flooding impacts on the Mitchell River. Refer to the flood mapping contained in the flood report. Impacts were identified in local tributaries, however, no adverse impacts are predicted in the Mitchell River by virtue of the much larger external catchment to the north which dominates flood conditions in the Mitchell River. Impacts will therefore not propagate to the lakes downstream.

Section 3.3.5 contains a figure showing a comparison of the Mitchell River 10% AEP flows and flows from selected site tributaries in a co-incident 1% AEP event. The hydrographs demonstrate that the much larger external catchment of the Mitchell River dominates flood conditions downstream of the site. Note that the regional flows shown are for a 10% AEP event and a co-incident 1% AEP would result in significantly higher flows.

3.13 Response to Recurring General Concerns

I have provided a response below to general flooding matters raised in numerous submissions as summarised in Table 3-6.

3.13.1 Extreme Rainfall and East Coast Lows

Many submissions contend that east coast low events pose a significant flood risk for the project and have not been considered. As part of the flooding assessment undertaken, I have assessed a worst-case flooding scenario involving the 1% AEP event with dams full, which is consistent with the intensity and pattern of rainfall typically associated with east coast lows.

Submission #70 alleges that up to 200mm of rain can fall on the site within a 24-hour period. Based on the IFD data (derived by BoM) which was used for the flooding assessments, the 1% AEP 24-hour design rainfall depth is 186mm, which is not dissimilar to the alleged amount. Also, as noted previously, the highest recorded 24-hour rainfall total (in 117-years of data) is 206mm.

Submission #896 alleges that 200-300mm of rain can fall in three (3) days. Based on the IFD data, 1% AEP 72-hour design rainfall depth is 238mm, which is again entirely consistent with the rainfall totals that are associated with east coast low events.

Furthermore, a comparison of AWAP and SILO rainfall datasets undertaken as detailed in the response to Submission #568 above confirms that the IFD data relied upon for the project is appropriate for the site.

In terms of the timing of dam construction and commissioning, east coast lows are a well-known risk and can be managed with appropriate dam construction scheduling, weather forecast monitoring and implementation of normal civil design safety and risk management procedures.

3.13.2 Risk of Dam Failure

Several submissions have raised issues regarding dam safety, the potential for cascading dam failures and associated impacts downstream. Dam failure impact assessments were not within the scope of the flooding assessments undertaken thus far, and are typically completed at the detailed design stage. Dam failure assessments (particularly cascading failures) are not usually undertaken at the preliminary design stage and provide little benefit without detailed civil design of the dams being available. Dam failure assessments can be conditioned and can be readily undertaken with subsequent detailed design.

The mine contact and process water dams have been sized to contain the volume of the 1% AEP (1 in 100-year ARI) 72hr storm. This storm event was selected because it is representative of a storm event caused by an east coast low as previously shown. The final design of the water management and tailings dams are a civil matter and will be designed in accordance with the latest ANCOLD guidance, including embankments and spillways etc., as specified in the Mitigation Register (Attachment H of the EES). Details can be provided when those structures undergo detailed design.

Further, the Mitigation Register commits to several management measures to minimise the risk of dam failure, including the following:

- (SW05) - Freeboards on the water storage dam, process water dam and sediment ponds will be maintained to allow for storm events and high rainfall periods, in accordance with relevant licence, permit and approval requirements.

- (SW12) - The design, construction and operation of the freshwater storage dam will follow the Australian National Committee on Large Dams (ANCOLD) Guidelines on the Consequence Categories for Dams.
- (SW33) - If during successive storm events, water management dams are required to be drawn down at a rate greater than can be achieved by the process water demand, mine contact water will be treated at a rate of 24 ML/day prior to discharge to the freshwater storage dam. Mine contact water will be treated to meet licence requirements prior to discharge offsite.

3.13.3 Impact of Climate Change on Flooding

Climate change is mentioned in many submissions. The following response relates generally to all of these, but specifically addresses Submissions #691 and #813, which specifically discuss climate change in relation to flooding.

Submission #691, under the heading “Weather Considerations”, contends that climate change is likely to exacerbate flooding and that according to a DELWP publication for East Gippsland, although there is an overall trend of declining rainfall, more of the rain that does fall will be in increasingly extreme downpours and this is likely to lead to an increase in the incidence of flooding. Climate change is also raised specifically in Submission #813.

Climate change assessments are standard sensitivity assessments undertaken at the detailed design stage. The effects of increase rainfall intensity can be readily investigated and for the purpose of detailed designed. Considering climate change as part of my assessment would not change the outcomes or conclusions of the design event modelling.

Climate change assessments for hydraulic modelling tend to be based on very simplistic assumptions regarding increased rainfall intensity. Generally, a multiplier is applied to the rainfall intensities to approximate the effect of a future warmer climate. Applying a multiplier to increase rainfall in this case would be of little consequence given the following:

- Resulting impacts will be marginally higher, though largely identical in terms of magnitude and spatial extent.
- No additional conclusions would be drawn from only applying a multiplier to rainfall given the above.
- Flows in the hydraulic model are already likely to be overestimates given the outcomes of the validation performed (refer to section 3.1).
- Our assessment has focused on a worst-case scenario in terms of on-site runoff storage availability (dams full), meaning that flooding impacts in the EES are likely to be overstated and will be lower in reality.
- Declining overall rainfall may result in drier dams which therefore may contain more flood storage capacity, acting as a buffer against any potential increases in rainfall intensity. It was found as part of the EMM Conceptual Surface Water Management Strategy and Water Balance Report (Appendix A006 (Appendix A) of the EES) that generally less water stored in the water management dams under climate change conditions.
- The simplistic methodology does not account for other climatic changes such as soil moisture (potentially drier soils and reduced runoff), modified temporal patterns due to changing prevailing weather conditions or potential changes to the spatial distribution in rainfall and is therefore very limited in this respect. The climate sensitivity water balance assessment performed by EMM (EES, Appendix A006 (Appendix A)) predicts that run-off volumes decrease in all conditions (wet, dry and average) due to overall lower rainfall totals and increased evaporation potential decreasing soil moisture content.
- The risk of climate change is small given the relatively short timeframe on the project.

4 DECLARATION

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Inquiry and Advisory Committee.

……………………………..

28 January 2021

APPENDIX A
CURRICULUM VITAE

JAMES WEIDMANN

James.Weidmann@watertech.com.au | Level 5, 43 Peel Street South Brisbane
Phone: 07 3105 1467

Senior Engineer

BEng. GDipEnvMan

QUALIFICATIONS

- Bachelor of Engineering (Double Major Environmental) 2012
- Graduate Diploma of Environmental Management (Sustainability) 2015

SUMMARY

James has considerable experience and expertise in the areas of water engineering, air quality, contaminated land and environmental management. At Water Technology, James specialises in flooding and drainage studies, hydrologic and hydraulic modelling, stormwater quantity and quality management, impact assessment, floodplain management and flood mitigation strategies. He has developed advanced proficiency in the use of TUFLOW, HEC-RAS, HY-8, XP-RAFTS, WBNM, URBS and MUSIC, and is on the cutting edge of utilising high resolution rain on grid hydrodynamic modelling and radar rainfall calibration techniques. One of James' key strengths is using GIS to produce high quality flood mapping.

James has recently completed work on a major flood study for the Mary River catchment involving detailed hydrology and hydraulic modelling using TUFLOW's Quadtree and Sub-Grid-Sampling capabilities. The project involved joint calibration of the models and complete assessment of flood behaviour in accordance with ARR19 methodology. James has also recently led the technical modelling team constructing detailed hydrological and hydraulic models for six (6) towns in the Somerset Regional Council area in accordance with ARR19 methodology. The quality of James' output will markedly assist developing accurate and effective floodplain management strategies for these regions. James also has previous experience working with Lockyer Valley Regional Council to develop and assess flood mitigation options for Laidley. James prepares detailed and concise technical reports offering specialised, best practice, sustainable and cost-effective solutions to clients.

PROFESSIONAL HISTORY

April 2018 – Present	Senior Engineer, Water Technology Pty Ltd, Brisbane
Nov 2017 – April 2018	Hydraulics and Flooding Engineer, Department of Transport and Main Roads, Brisbane (secondment)
May 2016 – July 2016	Environmental Engineer, MACH Energy, Brisbane (secondment)

May 2014 – April 2018	Water Engineer, Cardno, Brisbane
Aug 2011 – Nov 2012	Undergraduate Engineer, Pacific Environment Ltd, Brisbane
Feb 2008 – March 2013	Senior Field Operations Officer, Queensland State Emergency Service, Brisbane (volunteer)

SPECIALIST AREA OF EXPERTISE

- Flooding, Hydraulics and Stormwater Management
- Contaminated Land
- Environmental Management

RECENT MAJOR PROJECTS

MARY RIVER FLOOD STUDY – GYMPIE REGIONAL COUNCIL

James has recently completed work for a major flood study of the Mary River catchment. The project involved detailed hydrological and hydraulic modelling for a very large area which required overcoming numerous technical challenges. James achieved excellent joint calibration results and was involved in building the largest URBS model every constructed, and one of the largest and most detailed TUFLOW models employing SGS and Quadtree enhancements. Flood behaviour for the catchment was fully assessed hydraulically in accordance with ARR19 methodology. Results from the project will be used to inform updates to Council's planning scheme and flood preparedness strategies.

SOMERSET LOCAL FLOODPLAIN MANAGEMENT PLAN – SOMERSET REGIONAL COUNCIL

James recently led the technical modelling team constructing detailed hydrological and hydraulic models for six (6) towns in the Somerset Regional Council area. The project aimed to develop comprehensive flood mapping and inundation data for a range of design events to inform a subsequent floodplain management investigation for each town. This major project required a large degree of technical expertise, and coordination with other team members and the client. Using calibrated radar rainfall data, James was able to achieve an outstanding calibration of the hydrological and hydraulic models to the January 2011 event. The quality of James' output will markedly assist developing accurate and effective floodplain management strategies for the region.

ROWLEY ROAD REHABILITATION DETAILED FLOOD ASSESSMENT – STANTEC/MORETON BAY REGIONAL COUNCIL

Water Technology was engaged by Stantec as a sub-consultant to undertake a detailed flood assessment for a proposed upgrade to the heavily flood constrained Rowley Road in Burpengary. James commandeered this highly complex and technical project and worked closely with Stantec to achieve excellent design outcomes for the client. The project presented numerous challenges due to the intricacy of the catchment and flooding behaviour, and were further complicated by technical issues of employing the latest TUFLOW software. James undertook extensive sensitivity testing and verification of the complex SGS and Quadtree hydraulic model to identify an issue with the default turbulence (eddy viscosity) term in the latest TUFLOW release. James went above and beyond to assist Council in understanding the implications of the findings and helped Stantec develop a new road design which exceeded the clients' expectations.

ARCHERFIELD WETLAND STAGE 1 DETAILED FLOOD ASSESSMENT – URBIS PTY LTD/ OXLEY CREEK TRANSFORMATION PTY LTD

Water Technology was of a multi-disciplinary team lead by Urbis Pty Ltd to provide specialist advice regarding Stage 1 of the Archerfield Wetland Park Improvements project. The purpose of the overall Archerfield Wetlands project is to successfully transform the Oxley Creek corridor into a world class environmental asset and leisure attraction with usable community space for education, gathering, learning and recreation. James undertook detailed hydraulic modelling for the site and played a critical role in the Stage 1 detailed design due to the highly flood constrained land and ambitious design outcomes. The results of the assessment were used to evaluate and manage flood risk, inform developed levels and identify any impacts to surrounding properties. James also constructed a highly detailed MUSIC model for the site to inform the design of on-site stormwater treatment devices.

DETAILED ASSESSMENT BINNIES ROAD – ORCHARD PROPERTY GROUP

James developed a detailed TUFLOW model of Deebing Creek in Ripley (Qld) to assess a proposed new road and a major bridge and culvert crossing. The results of the assessment were used to inform the structural design for the road, bridge and culverts, including scour protection requirements for the structures and creek channel.

DOUBLE JUMP ROAD, VICTORIA POINT– SUTGOLD PTY LTD (FITENI HOMES)

Flooding and stormwater management plan for a large residential development proposal at Victoria Point (Qld) in the Redland City Council area. The assessment involved the development of detailed hydrology and hydraulics to demonstrate the proposed development constituted a compliant outcome in regard to the flooding and stormwater provisions of the Planning Scheme. The hydraulic assessment additionally included culvert sizing and detailed design of a constructed waterway.

THREE MOON CREEK BRIDGE – DEPARTMENT OF TRANSPORT AND MAIN ROADS

Hydraulic assessment of a proposed bridge upgrade involving the construction of a detailed TUFLOW model. The proposed bridge was assessed for flooding impacts, scour and road immunity.

MAJOR FLOOD LEVEE DESIGN – COUNCIL IN SOUTH EAST QUEENSLAND

Hydraulic assessment of a flood mitigation levee (detailed design) using TUFLOW. The assessment involved consideration of numerous mitigation strategies and design options.

GREEN CAMP ROAD – BRISBANE CITY COUNCIL

Preparation of a stormwater quality management plan for a road upgrade at Wakerley. The project involved MUSIC modelling, technical research and regular engagement with Council.

R&F DEVELOPMENT SPRINGFIELD – SPRINGFIELD LAKES

Completion of a regional flood impact assessment and local stormwater management plan for a large multi-stage residential, commercial and sporting precinct.

APPENDIX B
INSTRUCTIONS

10 November 2020

James Weidmann
Water Technology Pty Ltd
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South Brisbane QLD 4101

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Confidential and subject to legal professional privilege

Dear Mr Weidmann

Fingerboards mineral sands project

We act as legal advisors to Kalbar Operations Pty Ltd (**Kalbar**), the proponent of the Fingerboards mineral sands project (**Project**).

This letter confirms and sets out the scope of your retainer to prepare an expert witness statement and potentially also present evidence at the inquiry hearing to be held in relation to the environment effects statement (**EES**) prepared for the Project pursuant to the *Environment Effects Act 1978* (Vic).

1. The Project

Kalbar proposes to develop the Project on an area of approximately 1,675 hectares within the eastern part of the Glenaladale mineral sands deposit in East Gippsland, Victoria. The Project site is located near the Mitchell River, approximately 2 km south of Glenaladale, 4 km south-west of Mitchell River National Park and 20 km north-west of Bairnsdale.

The Project includes the development of an open cut mineral sands mine and associated infrastructure. It is expected to have a mine life of 15–20 years and involve extraction of approximately 170 Mt of ore to produce approximately 6 Mt of mineral concentrate for export overseas.

2. Panel and EES inquiry

The EES and the studies and assessments that underpin it (together with a draft planning scheme amendment and application for an EPA works approval) are presently on public exhibition until the end of October 2020.

The inquiry is scheduled to convene its directions hearing on 13 November 2020, and the inquiry hearing is scheduled to commence on 7 December 2020. We will keep you informed of any relevant directions, including the timetable for filing evidence and, if required, any expert conferences.

3. Scope

This letter is confirmation of your engagement as an independent expert to:

(a) prepare an expert witness statement in which you:

  (i) set out your background and relevant expertise;

(ii) briefly describe and summarise the surface water assessments prepared in support of the EES – both the site and regional studies - and your role in preparing them. In particular, we ask that you detail whether there is anything in the report that you disagree with or wish to elaborate on and set out any additional information that you consider necessary to include, including any additional assumptions;

(iii) consider the submissions that are relevant to your area of expertise and respond to any issues raised; and

(b) if required, prepare and present expert evidence at the inquiry hearing.

We will provide further instructions on the scope of your engagement and any new instructions as necessary.

4. Form of your expert witness statement

The form and content of your expert witness statement should be prepared in accordance with Planning Panel Victoria's *Guide to Expert Evidence* (**Guide**). We enclose a copy of the Guide for your reference. Please review the Guide and ensure your witness statement addresses the matters set out in it, in particular those matters listed under the heading 'The expert witness statement'. Please contact us if there is anything in the Guide that you do not understand, or if you have questions in relation to it.

Until your expert witness statement is in final form it should not be signed. You should, however, be aware that unsigned documents may need to be disclosed to other parties.

5. Your duties and responsibilities as an expert witness

Even though you are engaged by Kalbar, you are retained as an expert to assist the inquiry, and you have an overriding duty to it. The inquiry will expect you to be objective, professional and form an independent view as to the matters in respect to which your opinion is sought.

6. Timing

The timing for completion of your expert witness statement is to be advised. We will let you know as soon as we can.

7. Conflict of interest

It is important that you are free from any possible conflict of interest in providing your advice. You should ensure that you have no connection with any potential party to this matter that could preclude you from providing your opinion in an objective and independent manner.

10 November 2020

8. Costs and invoicing

Water Technology Pty Ltd will continue to be contractually engaged by Kalbar and Kalbar will continue to be responsible for the payment of your fees. Your accounts should be sent directly to the appropriate person nominated by Kalbar.

9. Confidentiality

Your engagement and any documents you prepare under it should be marked "Confidential and subject to legal professional privilege".

If anyone other than ourselves, Kalbar or its technical advisers contact you about this engagement or the work you are undertaking under this engagement, please contact us immediately.

If you have any questions about this letter or require any additional information, please contact us.

Yours sincerely,

Tim Power

Kirsty Campbell

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Partner

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E tim.power@whitecase.com

Kirsty Campbell
Senior Associate

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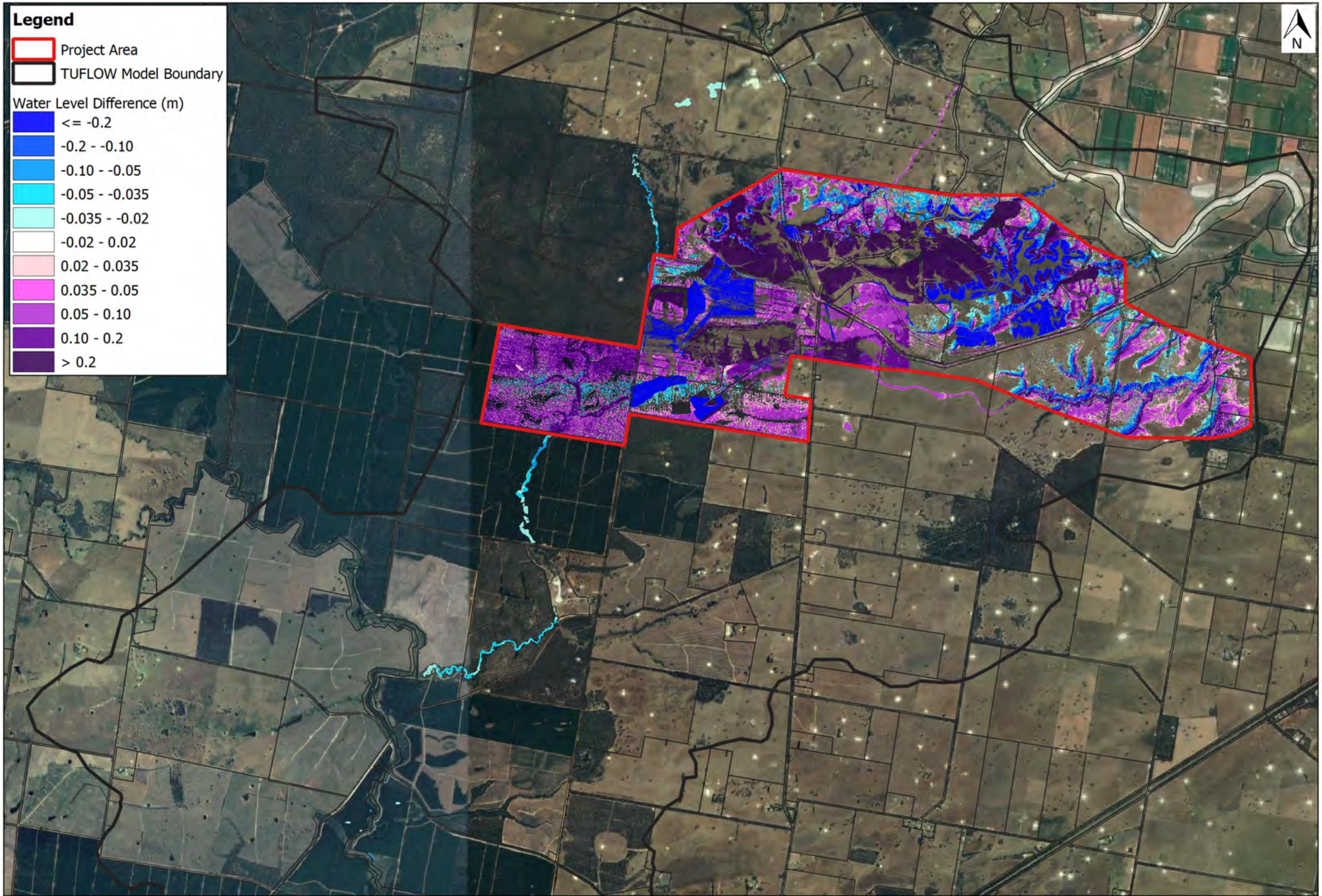
E kirsty.campbell@whitecase.com

Enc: Planning Panel Victoria's *Guide to Expert Evidence* - April 2019

APPENDIX C
FLOOD IMPACT MAPPING



Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

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Fingerboards EES Flood Assessment

Water Level Difference - Year 5 vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY

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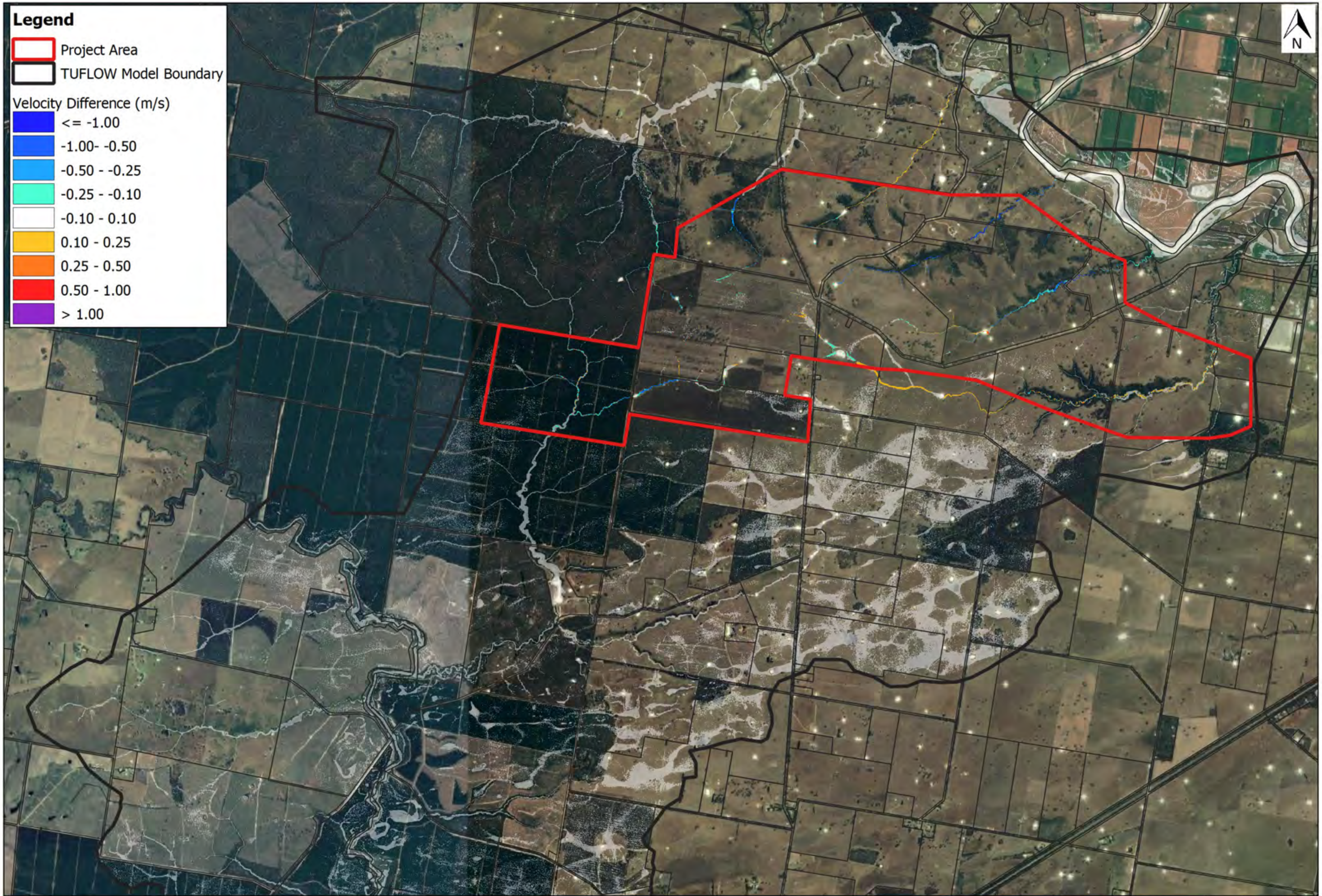

Fingerboards EES Flood Assessment

Velocity Difference - Year 5 vs Existing - 2 year ARI 9hr Event

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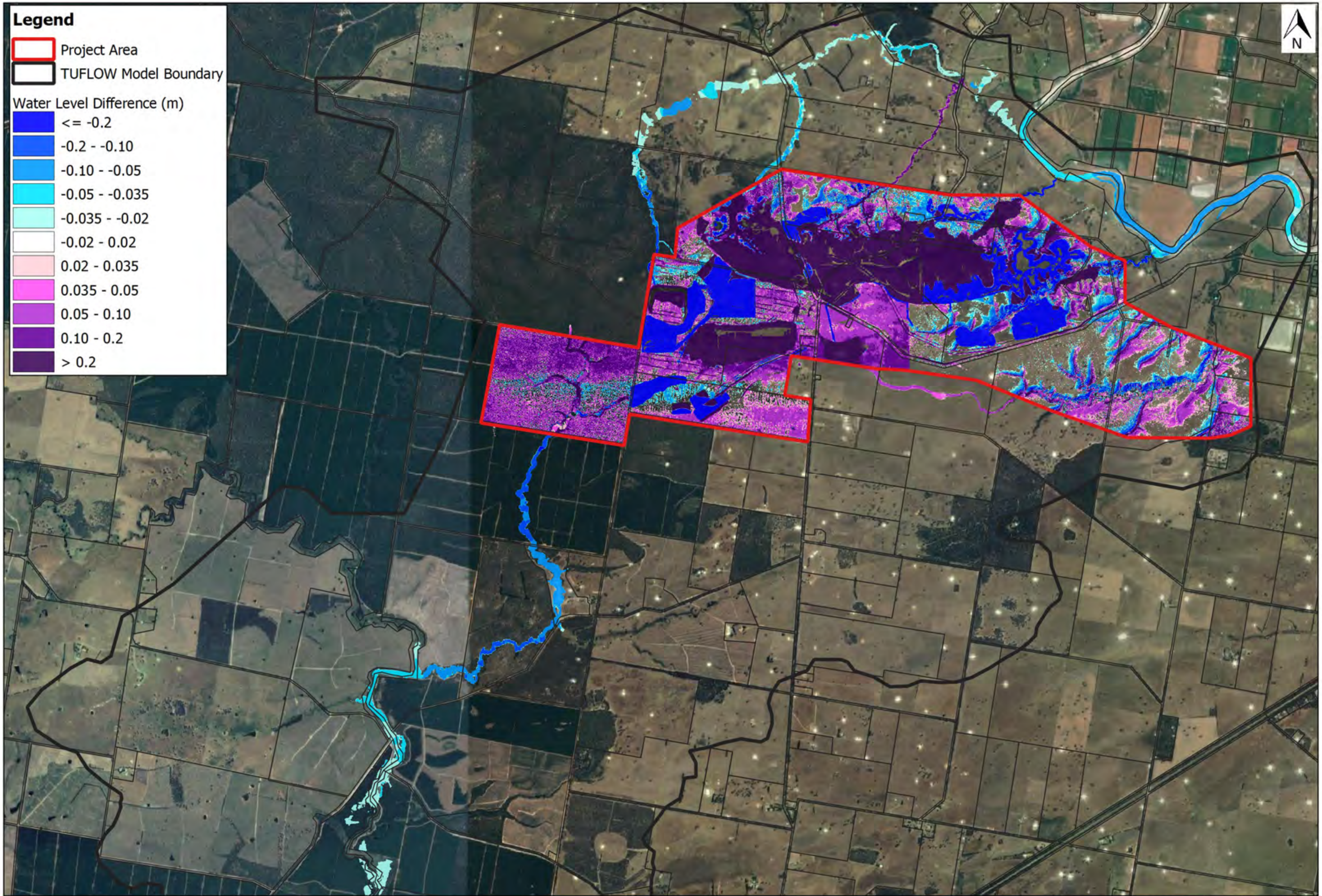

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 5 vs Existing - 100 year ARI 1hr Event

WATER TECHNOLOGY

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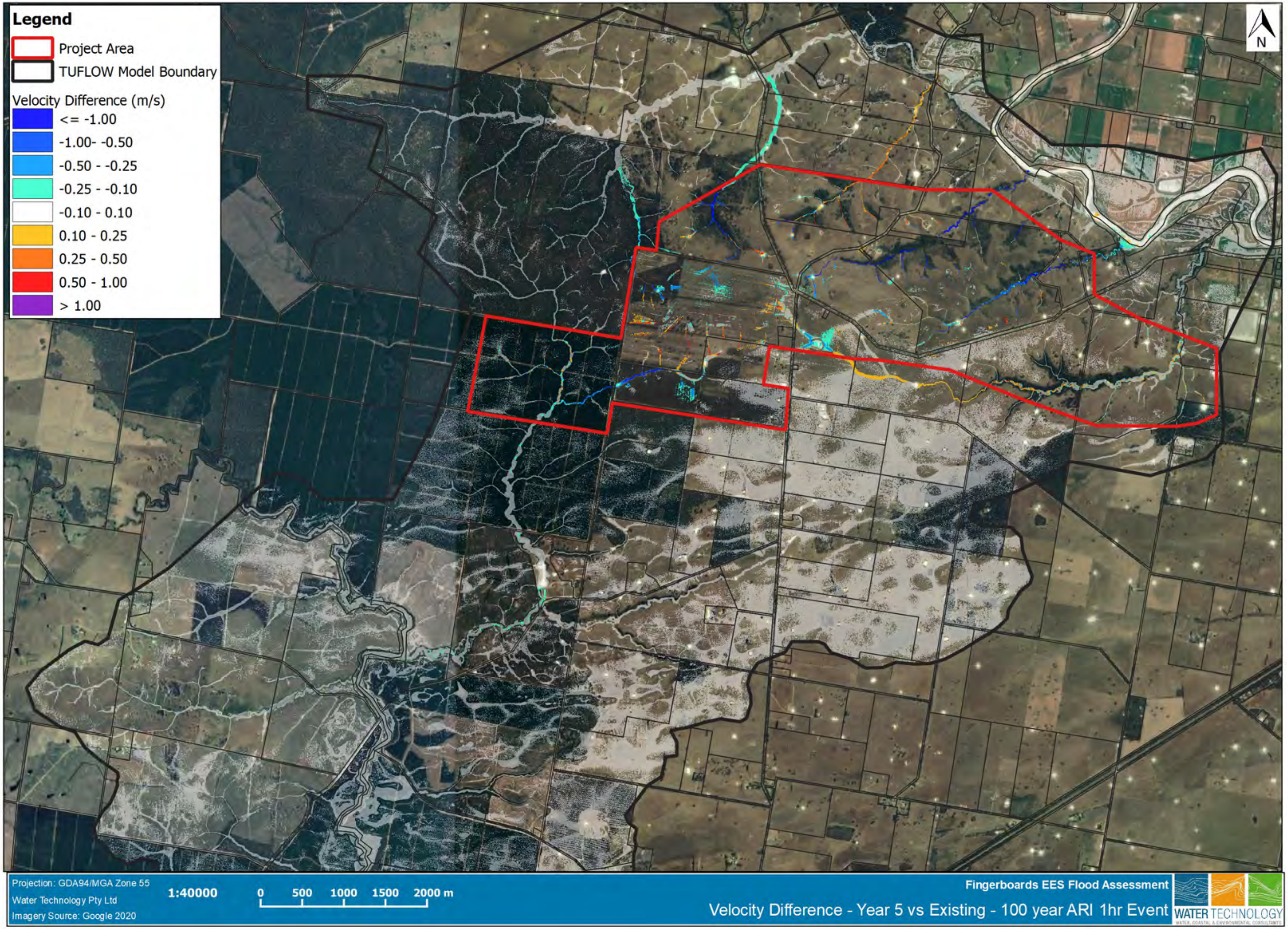

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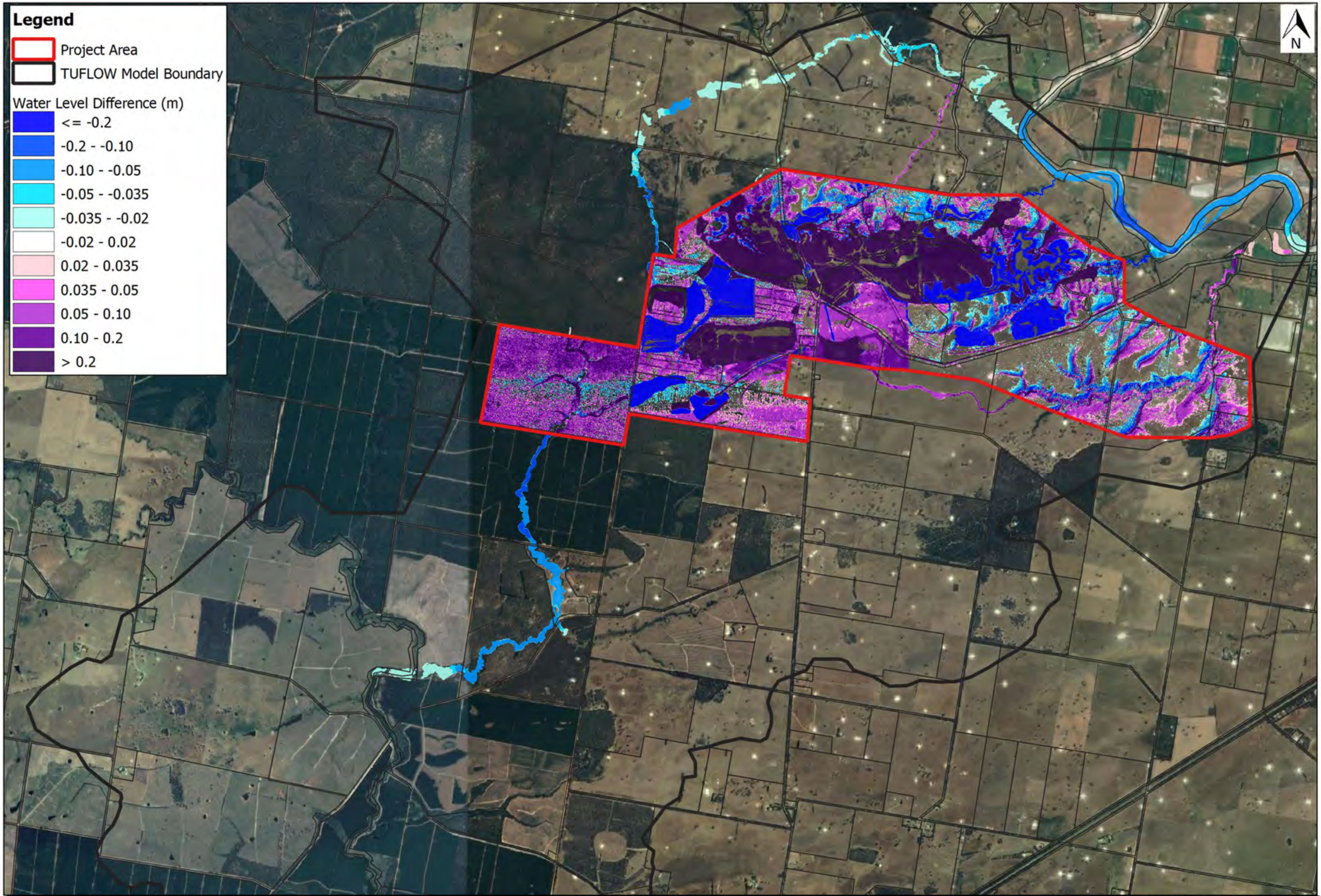

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

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0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 5 vs Existing - 100 year ARI 6hr Event

WATER TECHNOLOGY

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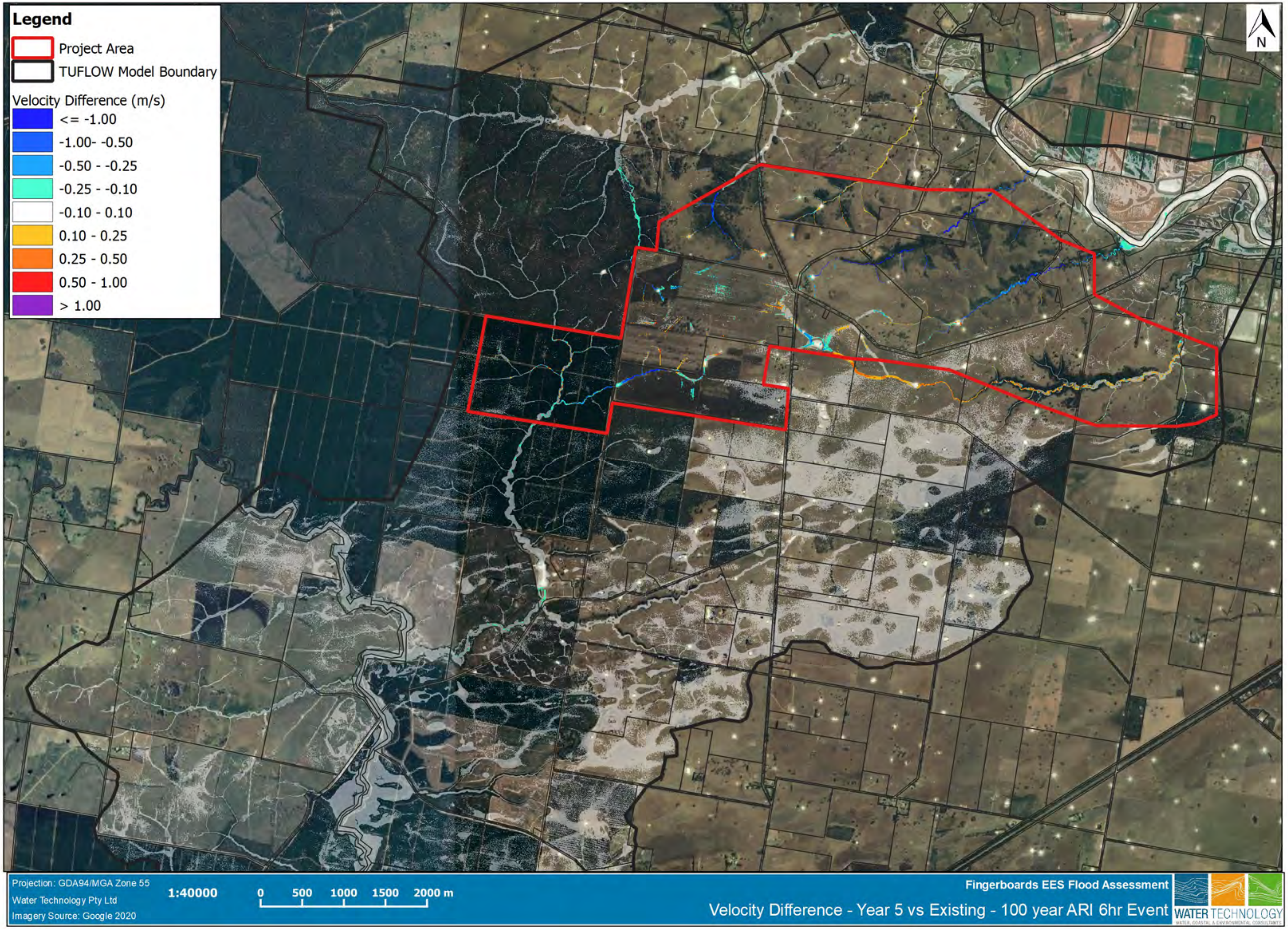

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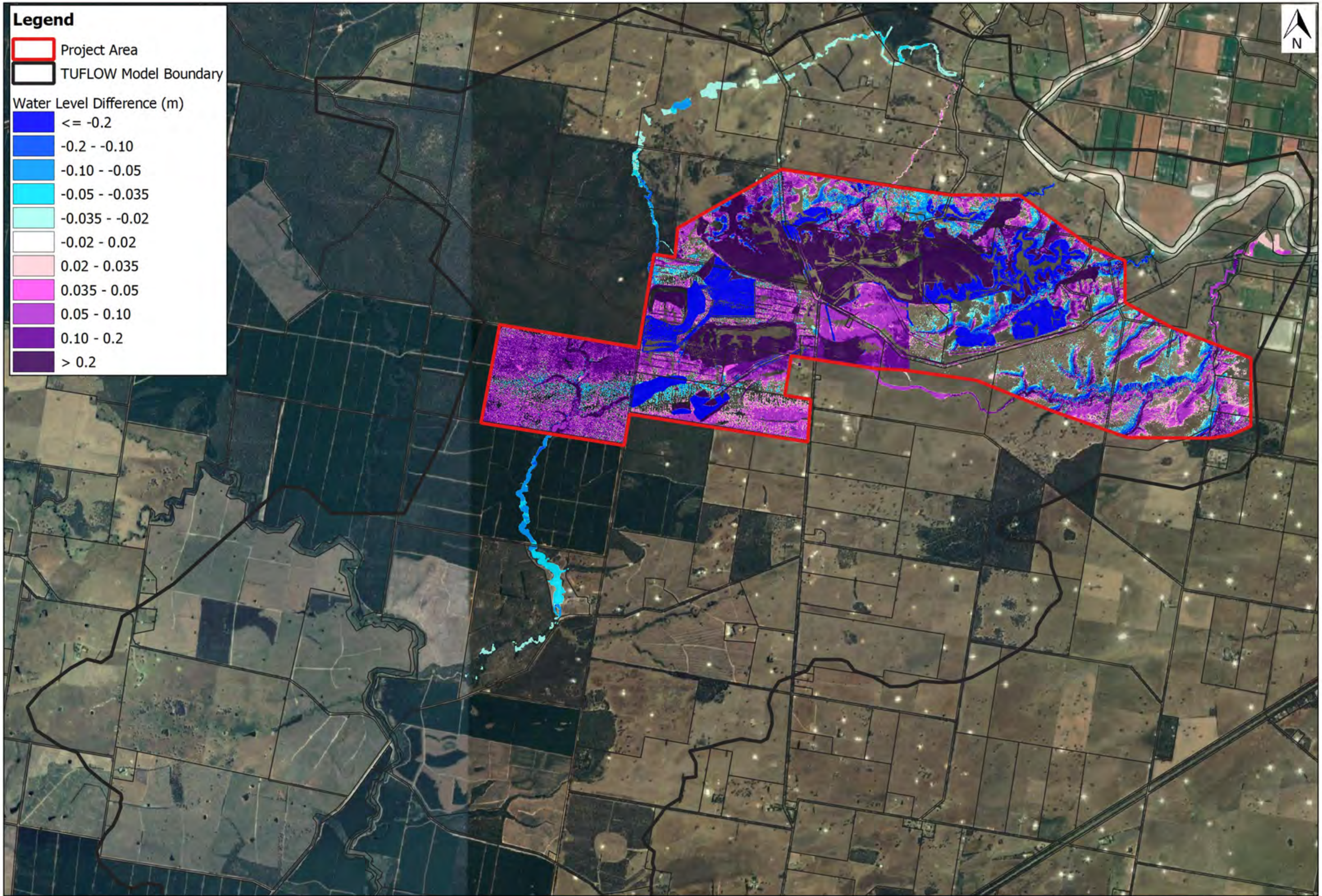

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 5 vs Existing - 100 year ARI 12hr Event

WATER TECHNOLOGY

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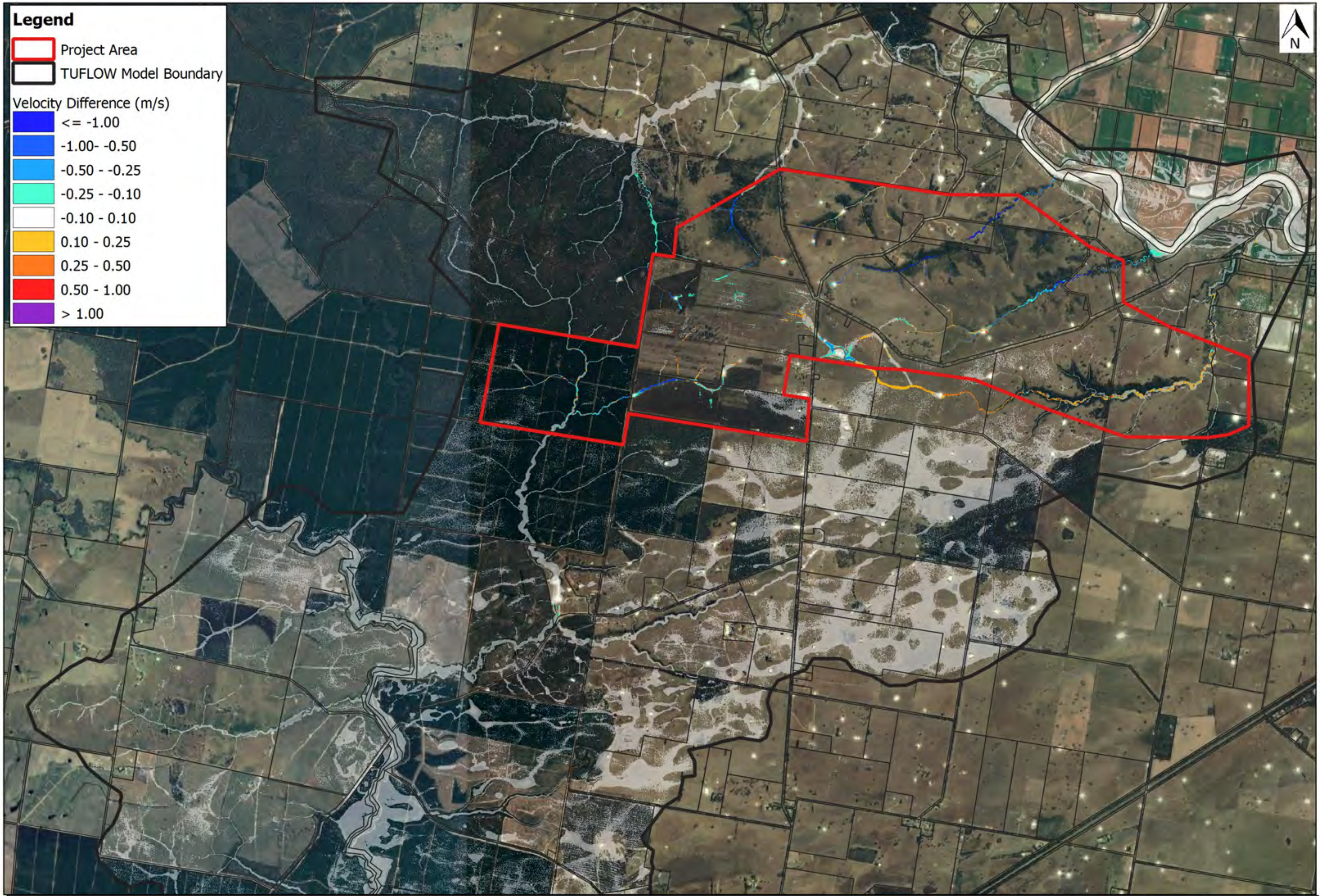

Fingerboards EES Flood Assessment

Velocity Difference - Year 5 vs Existing - 100 year ARI 12hr Event

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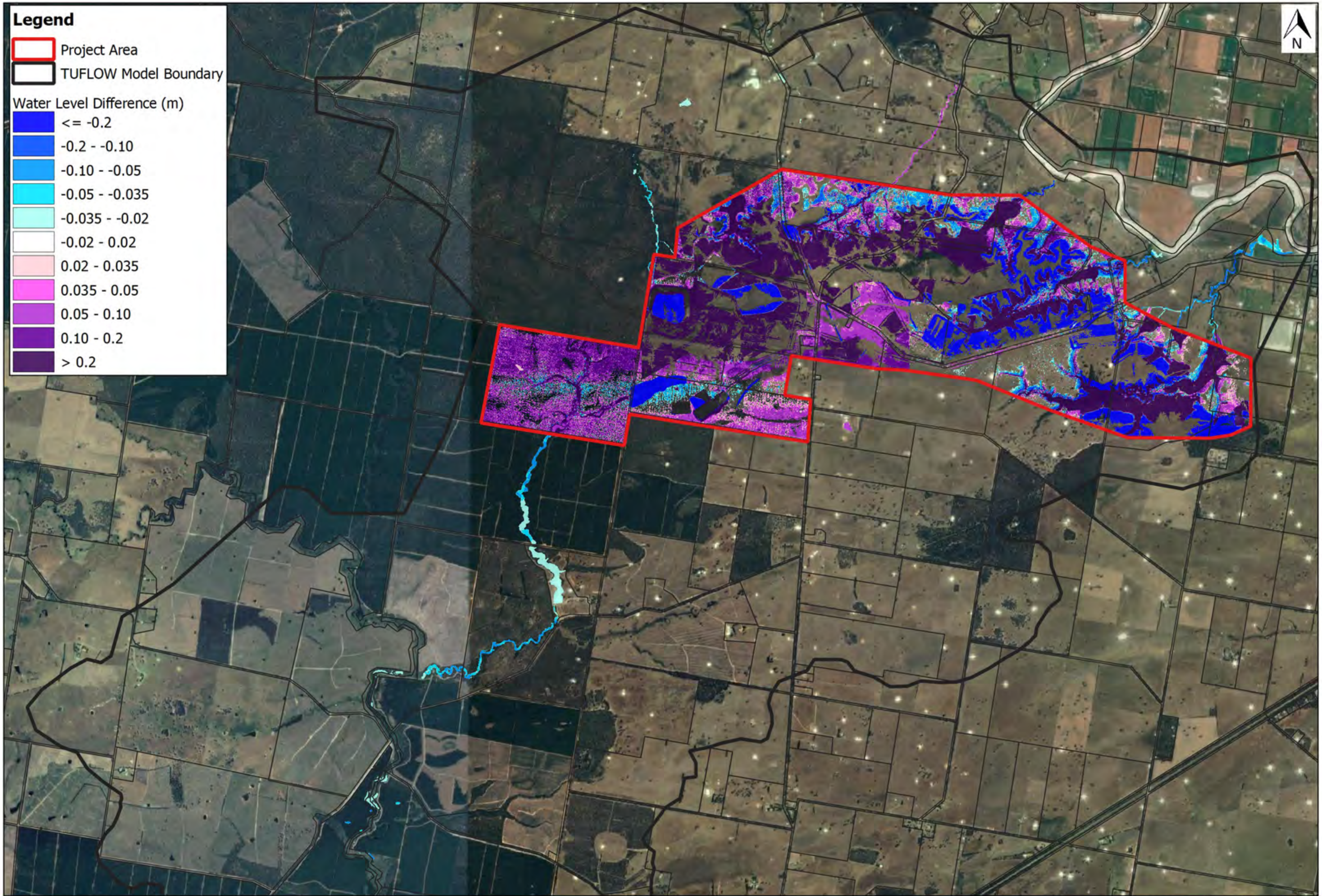


Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

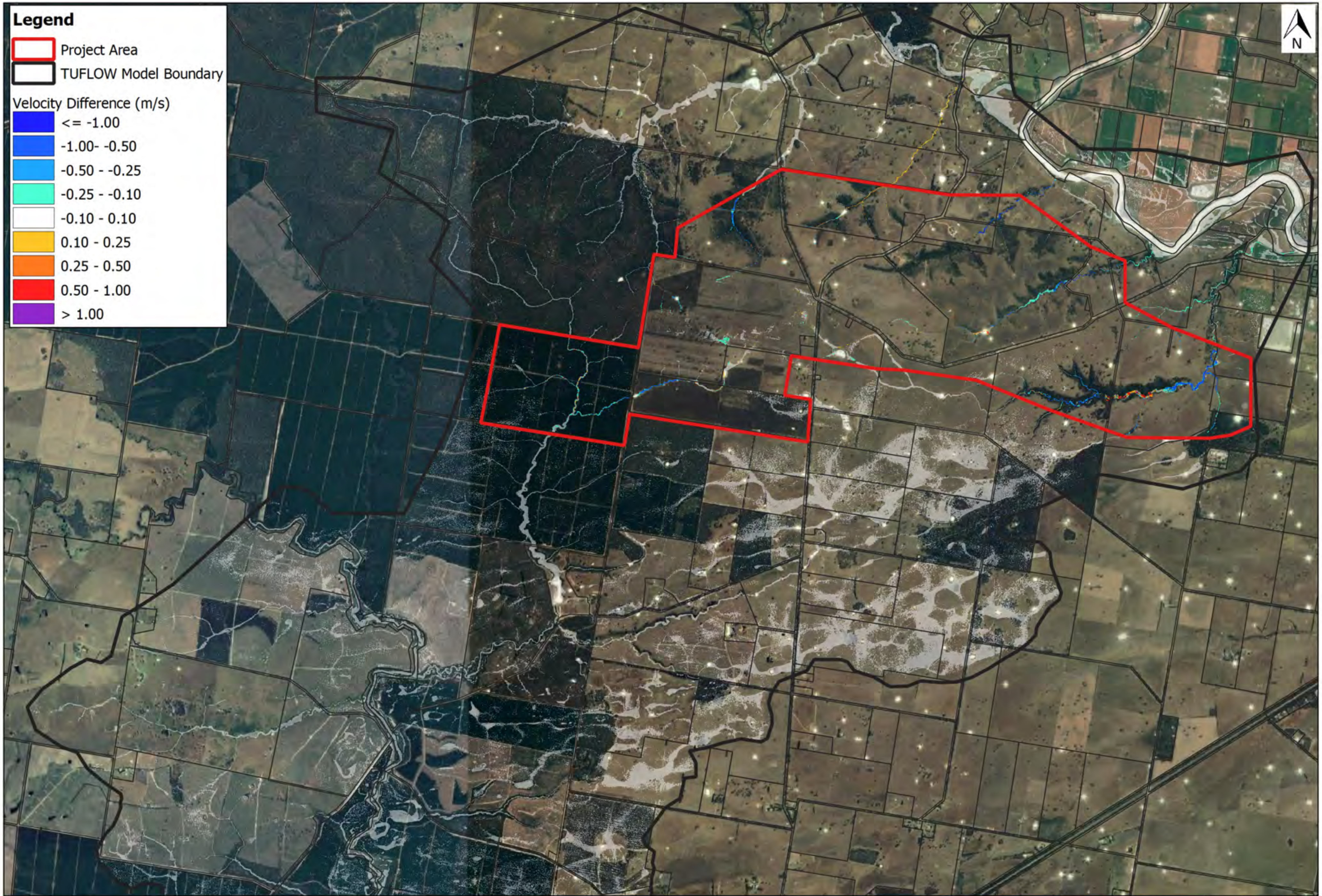
0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 8 vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY

020-11-28T12:54:48.886



Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

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Fingerboards EES Flood Assessment

Velocity Difference - Year 8 vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY

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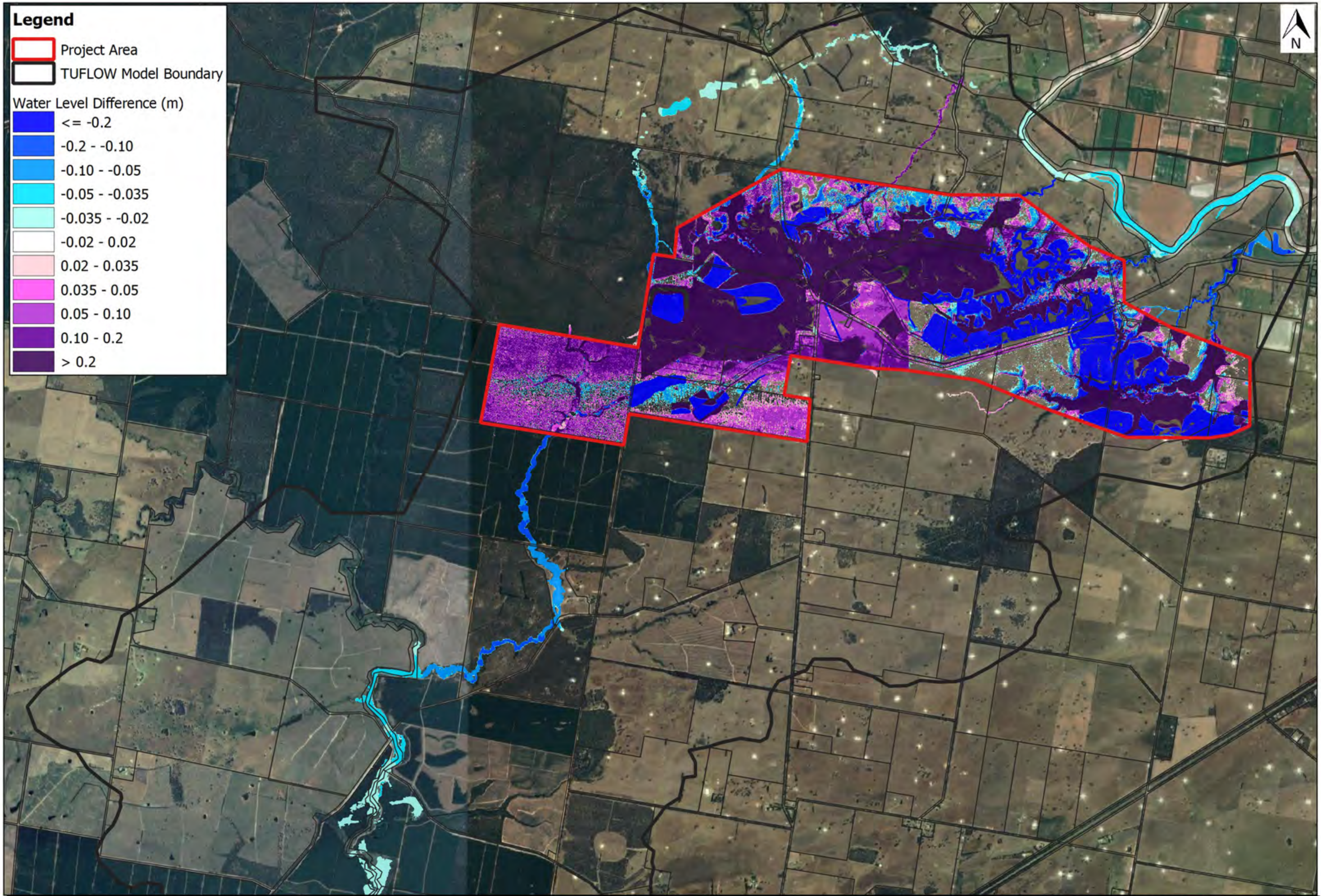


Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

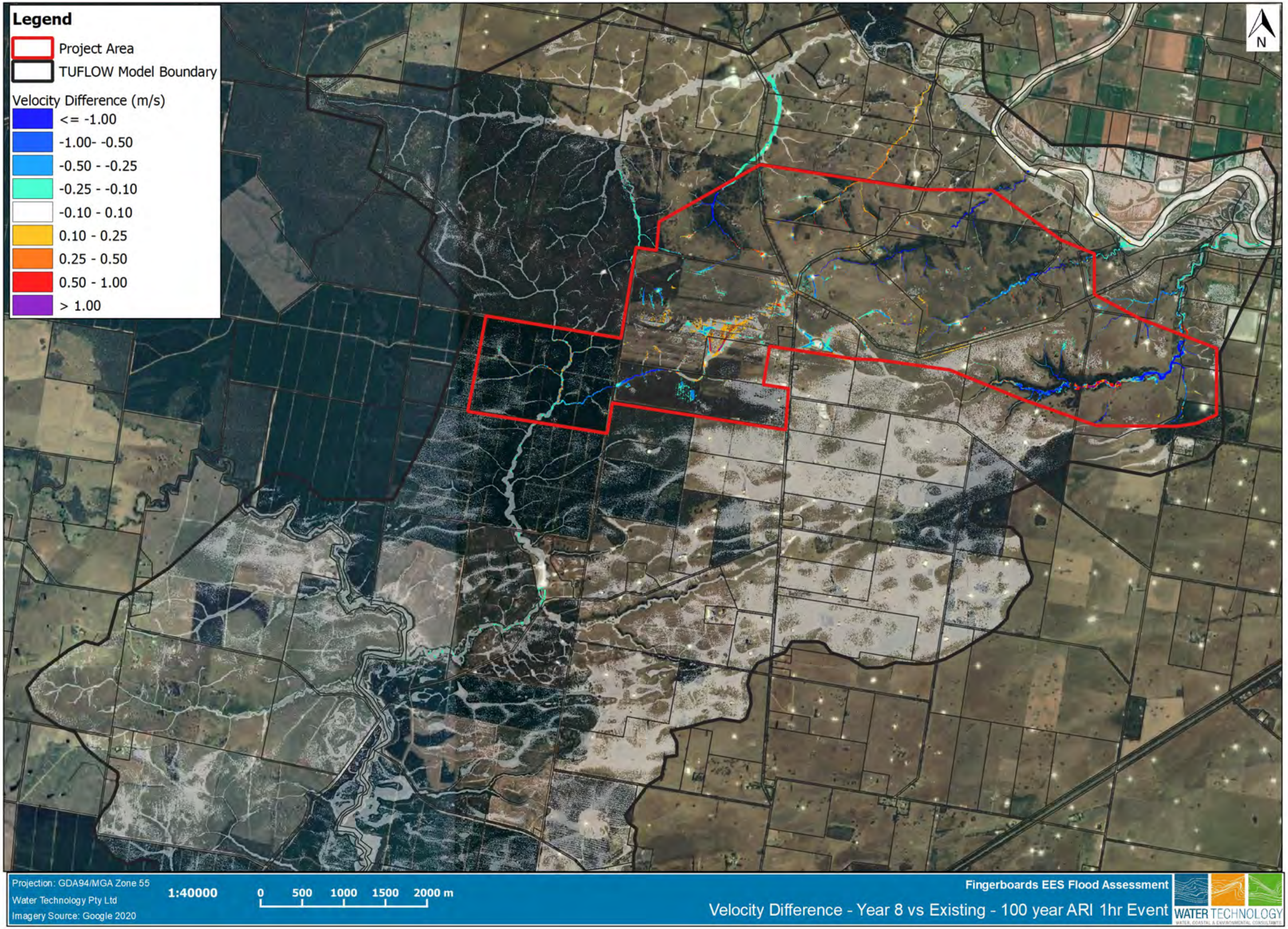
0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

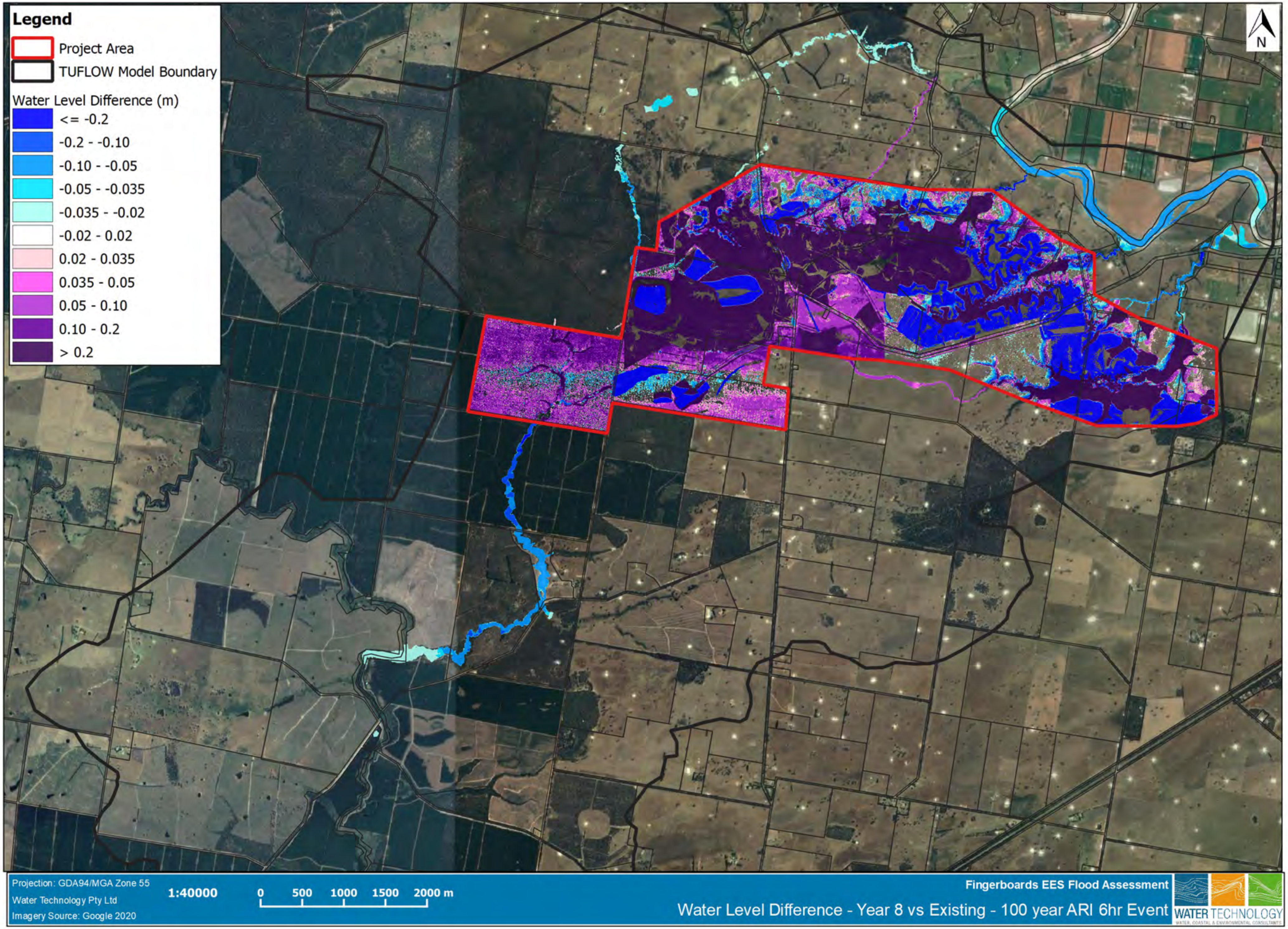
Water Level Difference - Year 8 vs Existing - 100 year ARI 1hr Event

WATER TECHNOLOGY

020-11-28T12:54:57.946



Legend
Project Area
TUFLOW Model Boundary
Velocity Difference (m/s)
<= -1.00
-1.00- -0.50
-0.50 - -0.25
-0.25 - -0.10
-0.10 - 0.10
0.10 - 0.25
0.25 - 0.50
0.50 - 1.00
> 1.00
N
Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020
1:40000
0 500 1000 1500 2000 m
Fingerboards EES Flood Assessment
Velocity Difference - Year 8 vs Existing - 100 year ARI 1hr Event
WATER TECHNOLOGY



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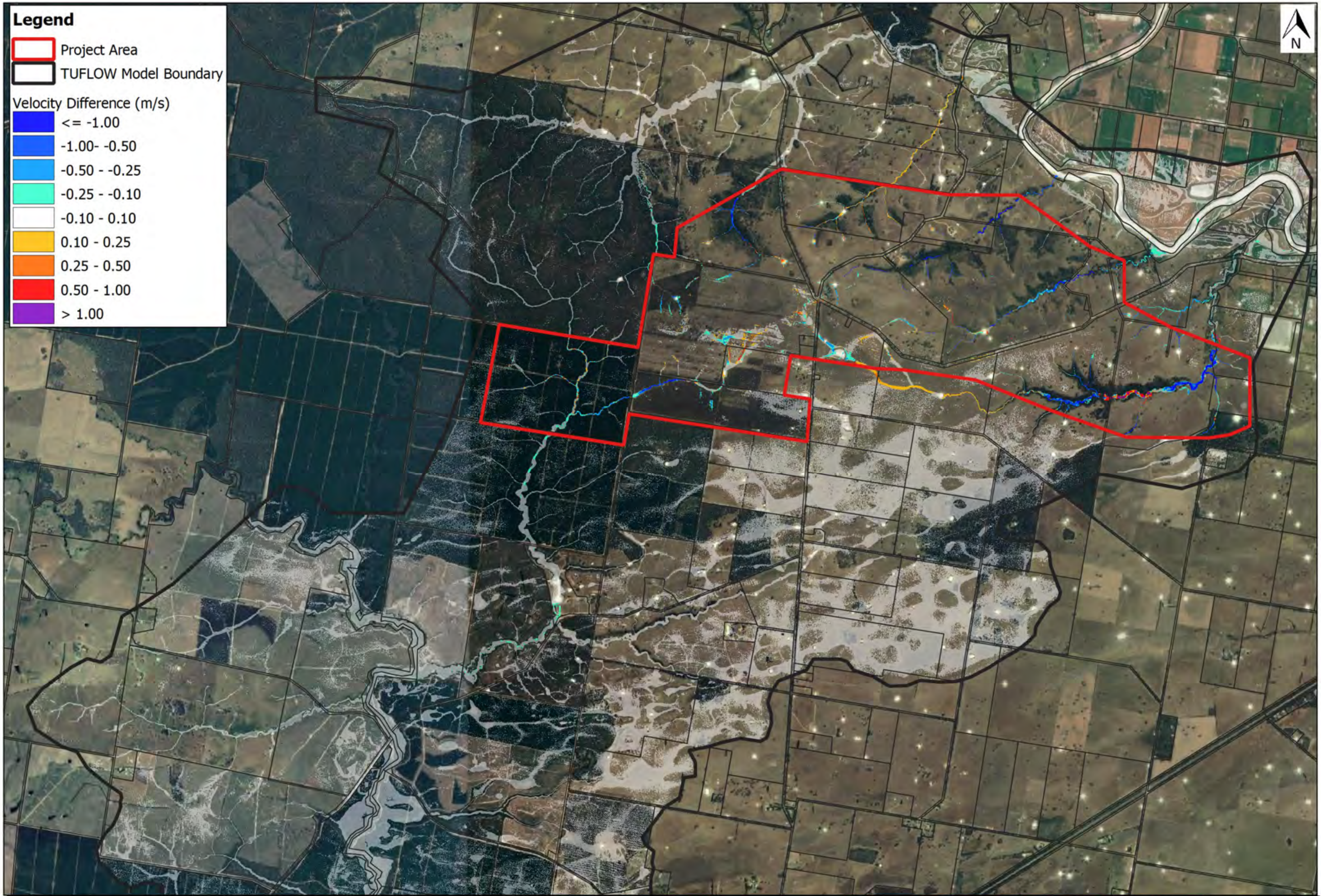


Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

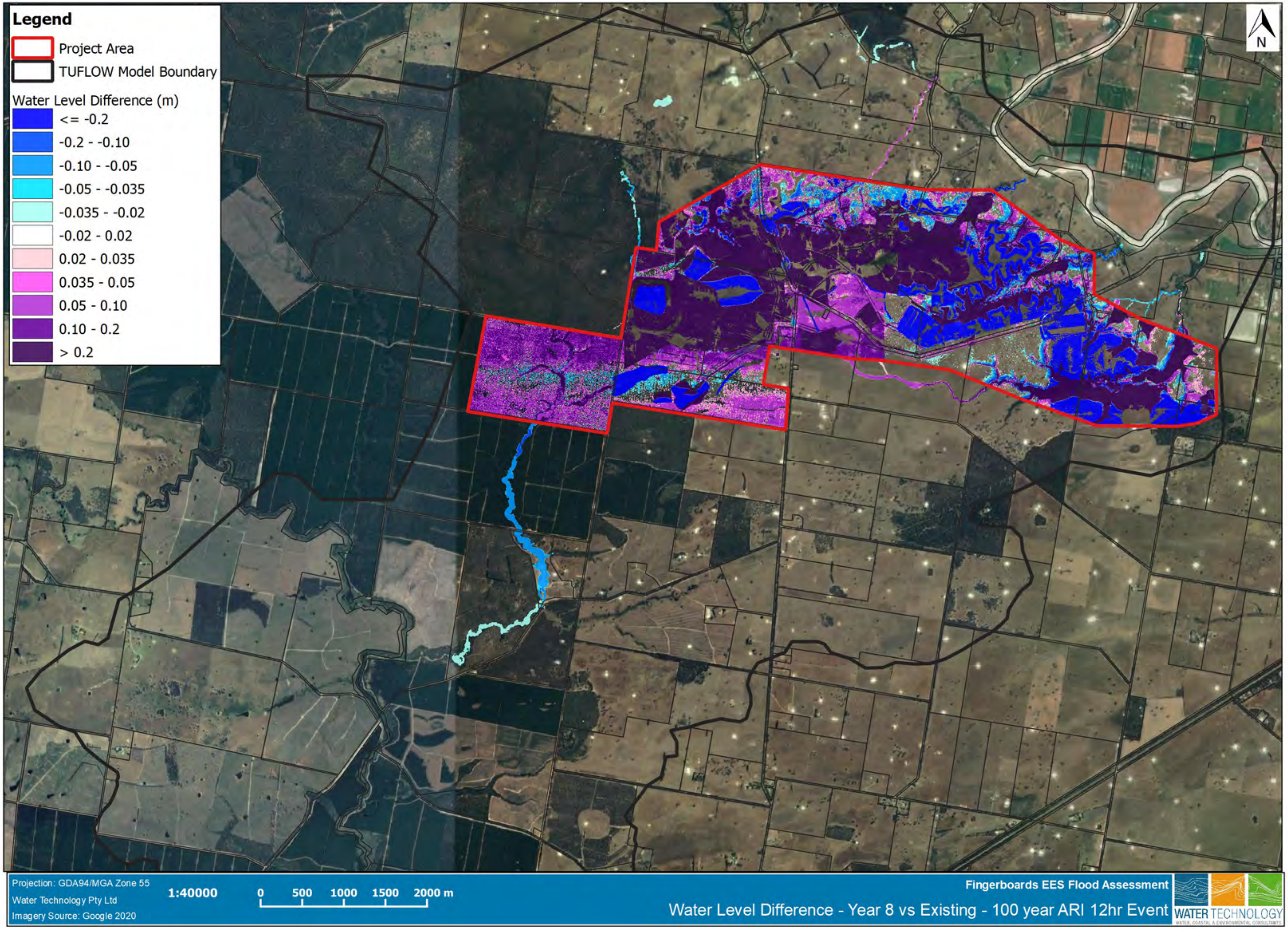
0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Velocity Difference - Year 8 vs Existing - 100 year ARI 6hr Event

WATER TECHNOLOGY

020-11-28T12:55:12.517



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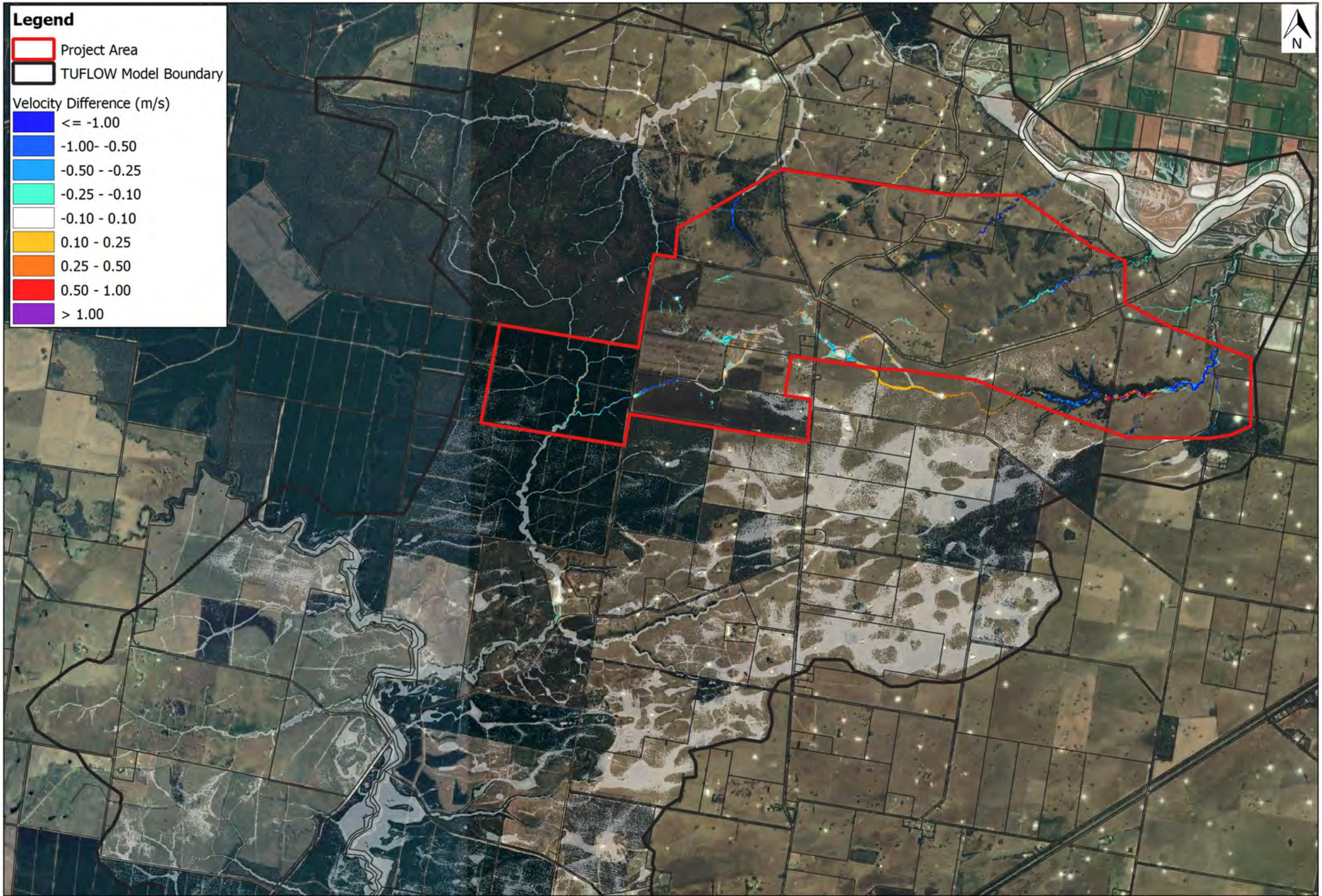

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Velocity Difference - Year 8 vs Existing - 100 year ARI 12hr Event

WATER TECHNOLOGY

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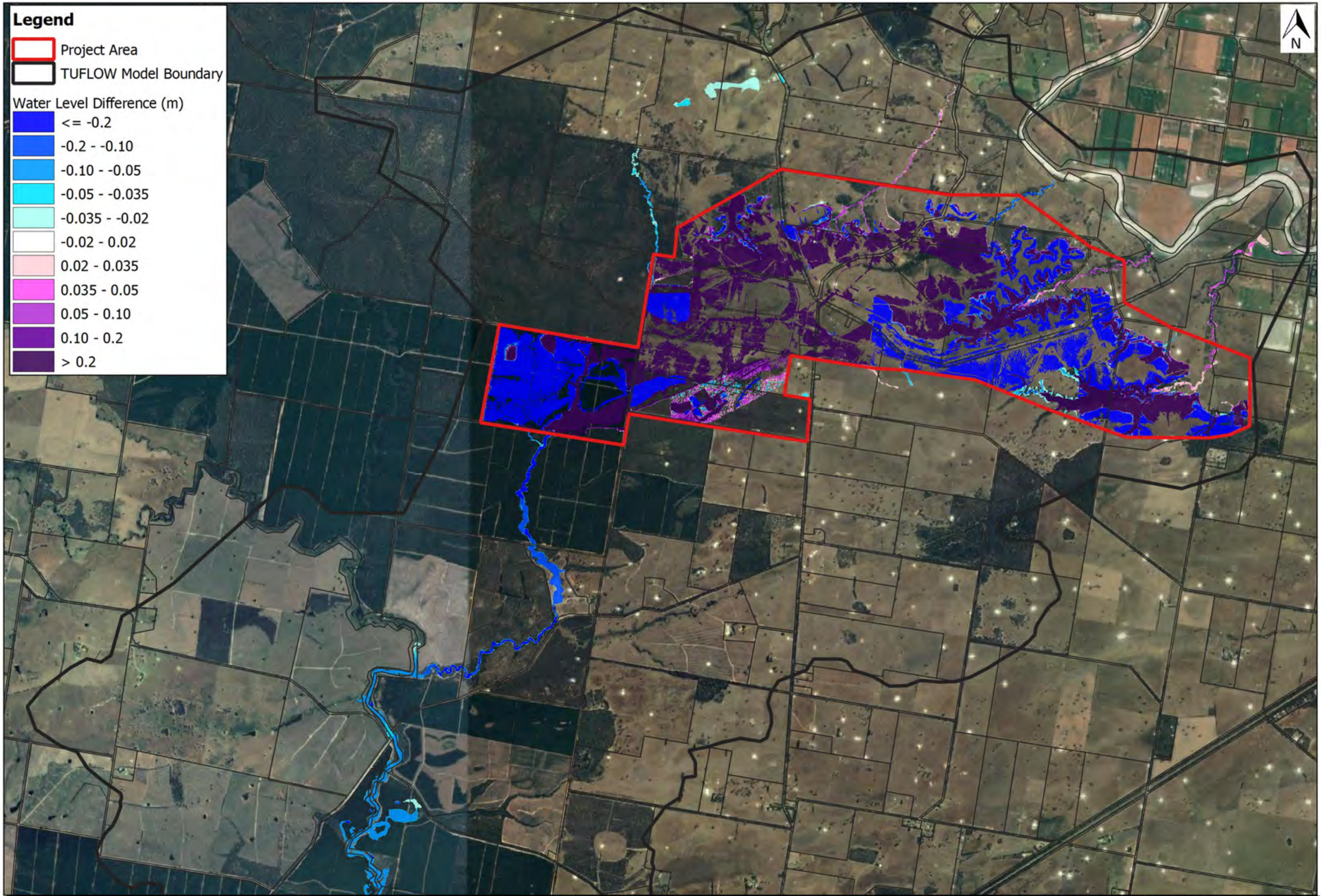


Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

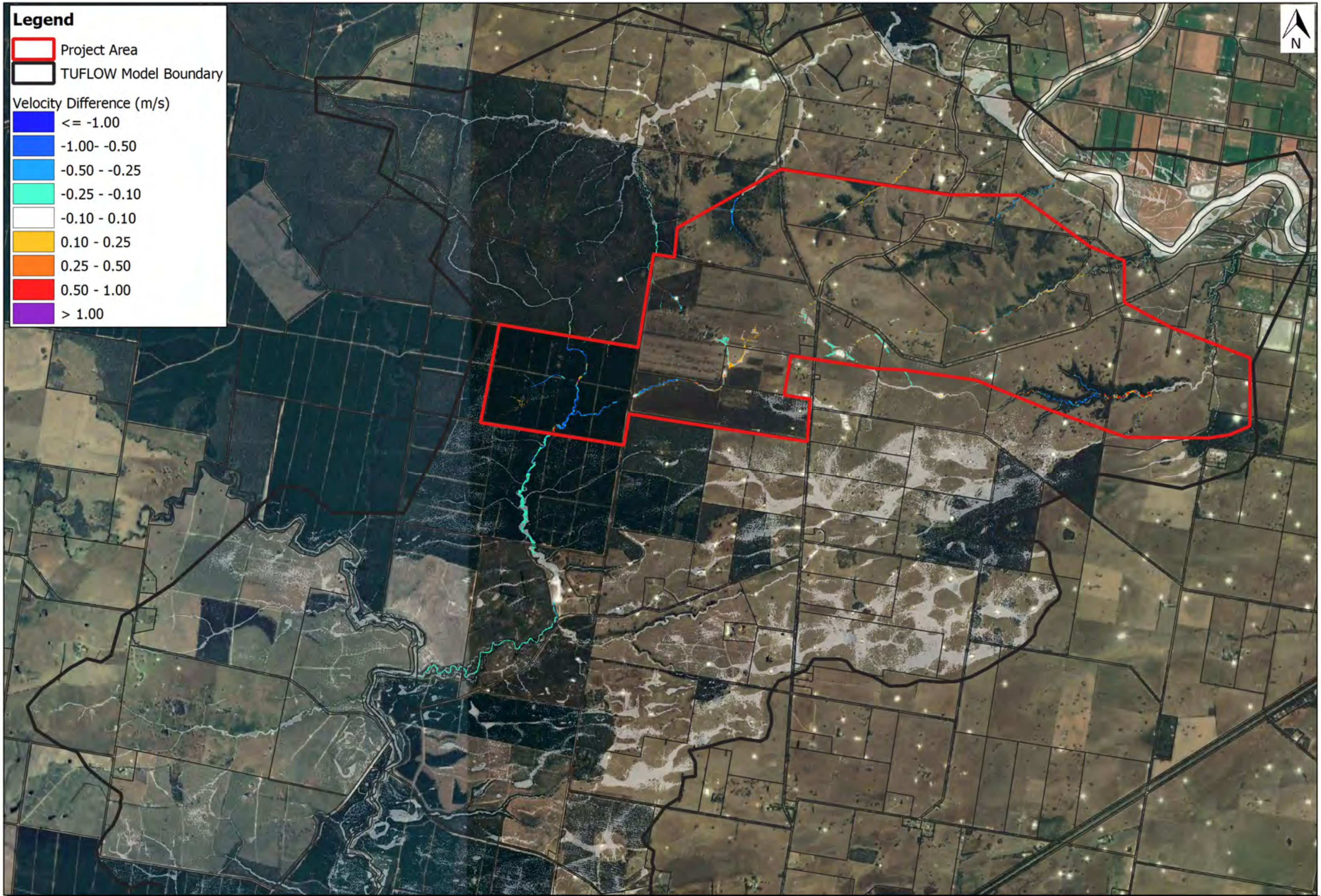
0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 15 vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY

020-11-28T12:55:26.634



Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

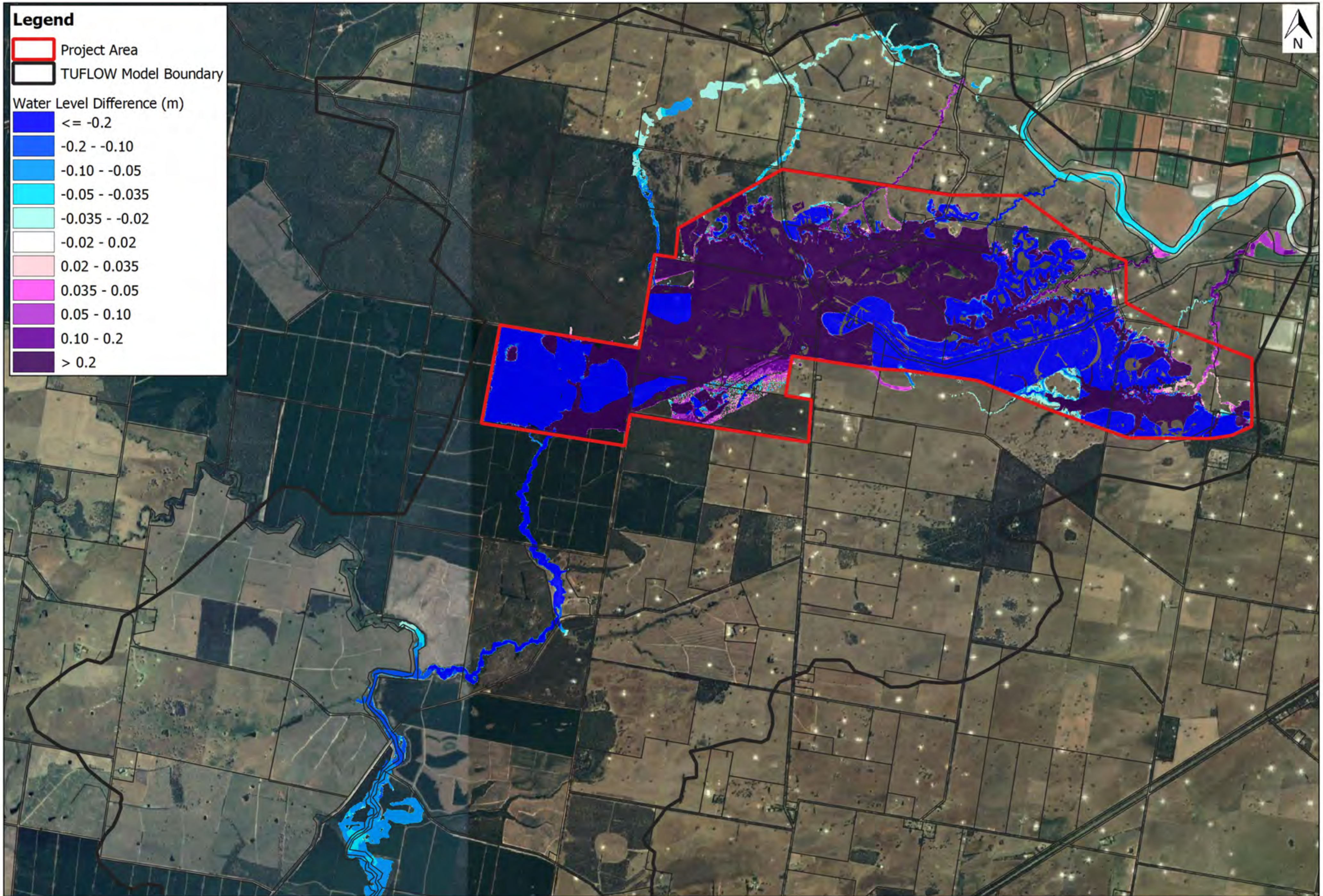
0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Velocity Difference - Year 15 vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

020-11-28T12:55:31.445



Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

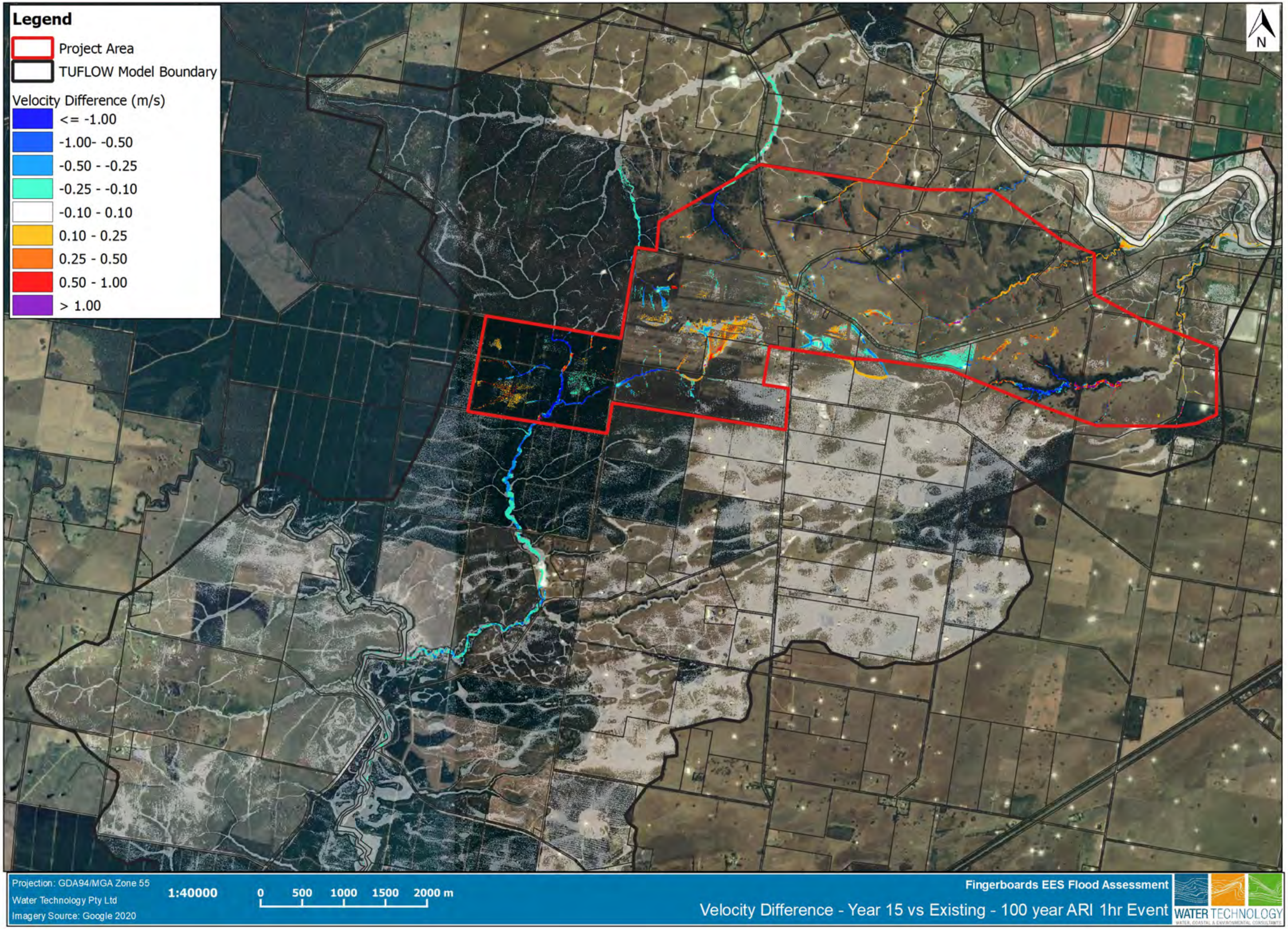
0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 15 vs Existing - 100 year ARI 1hr Event

WATER TECHNOLOGY

020-11-28T12:55:35.032



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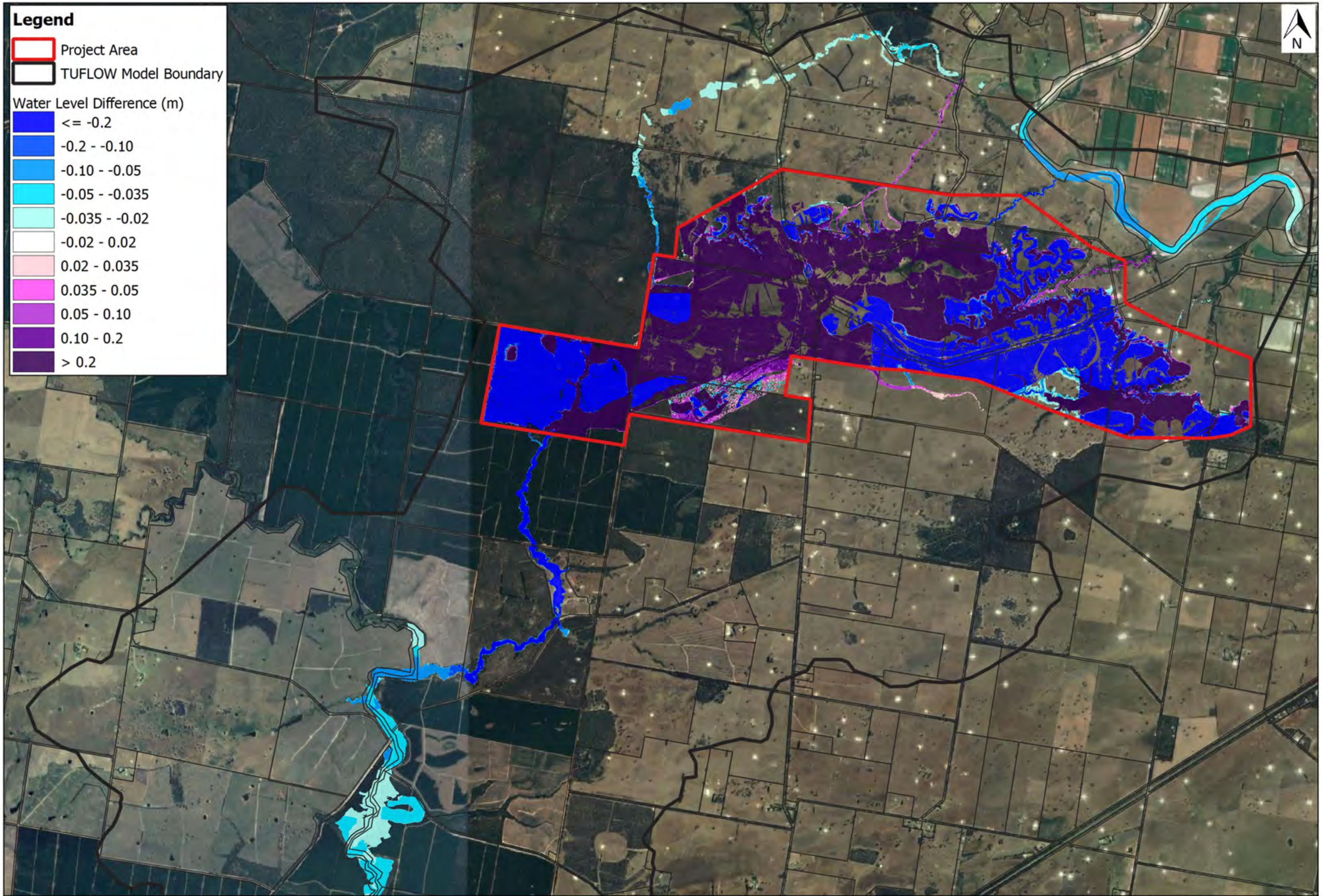

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

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0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 15 vs Existing - 100 year ARI 6hr Event

WATER TECHNOLOGY

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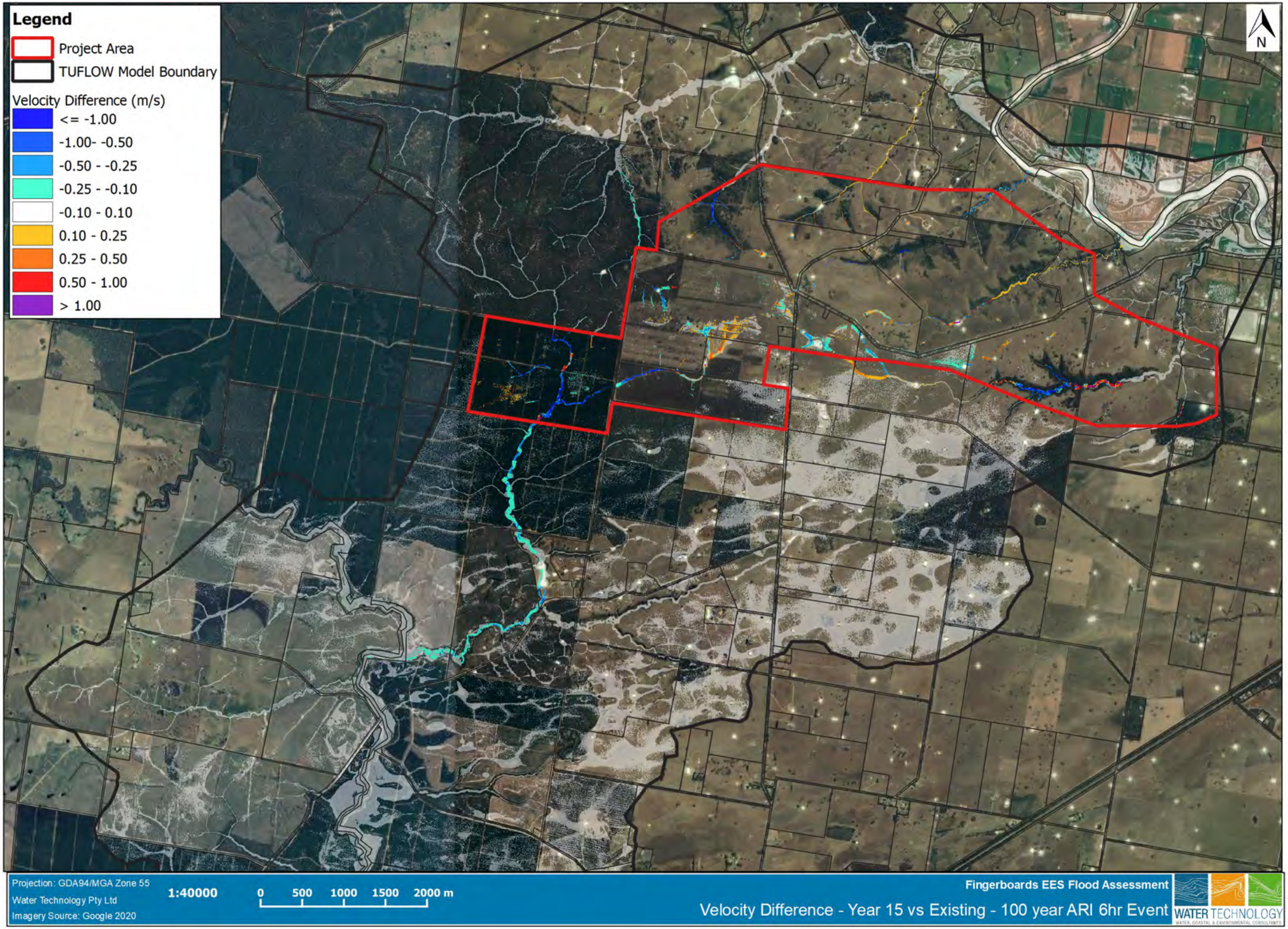

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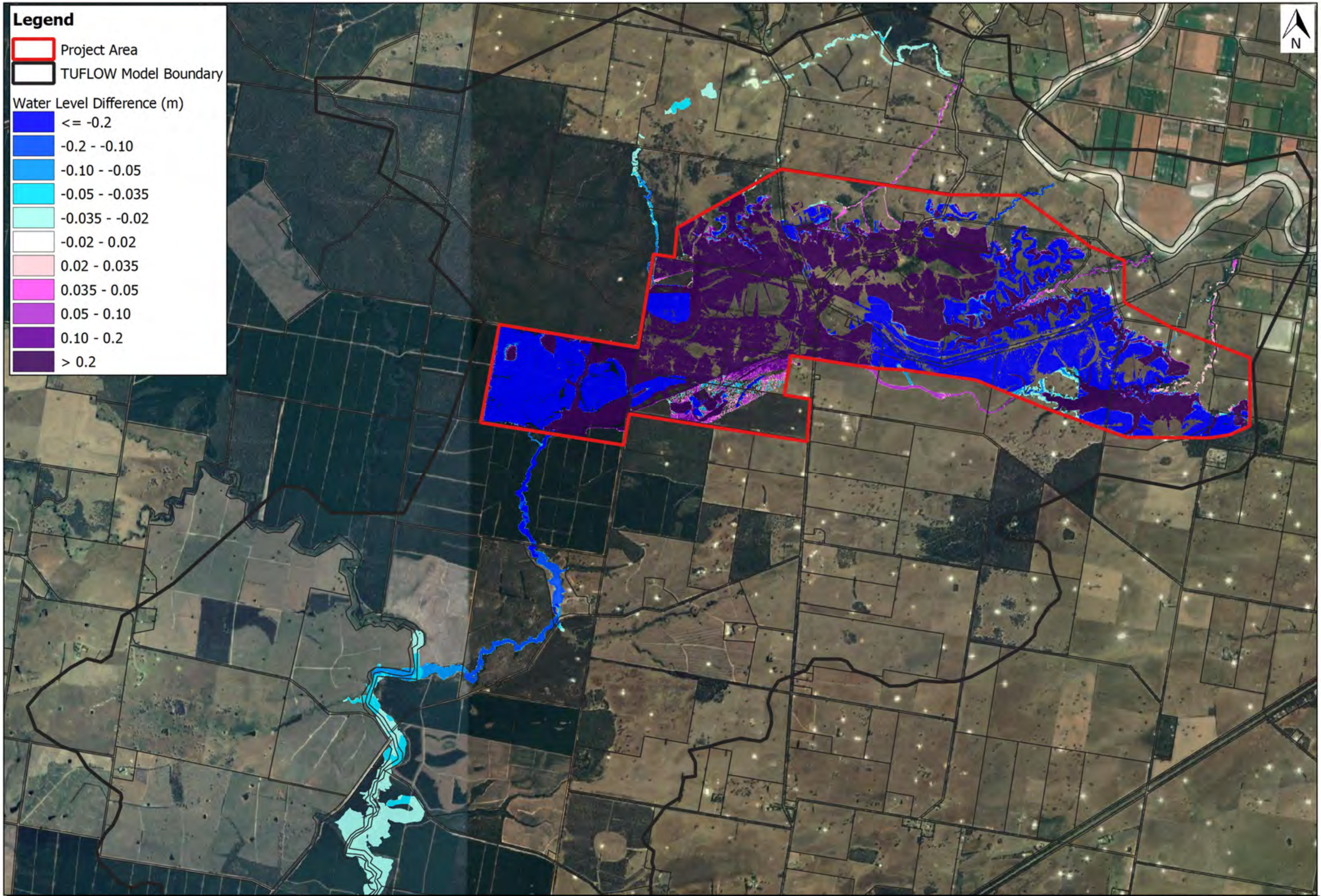

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Year 15 vs Existing - 100 year ARI 12hr Event

WATER TECHNOLOGY

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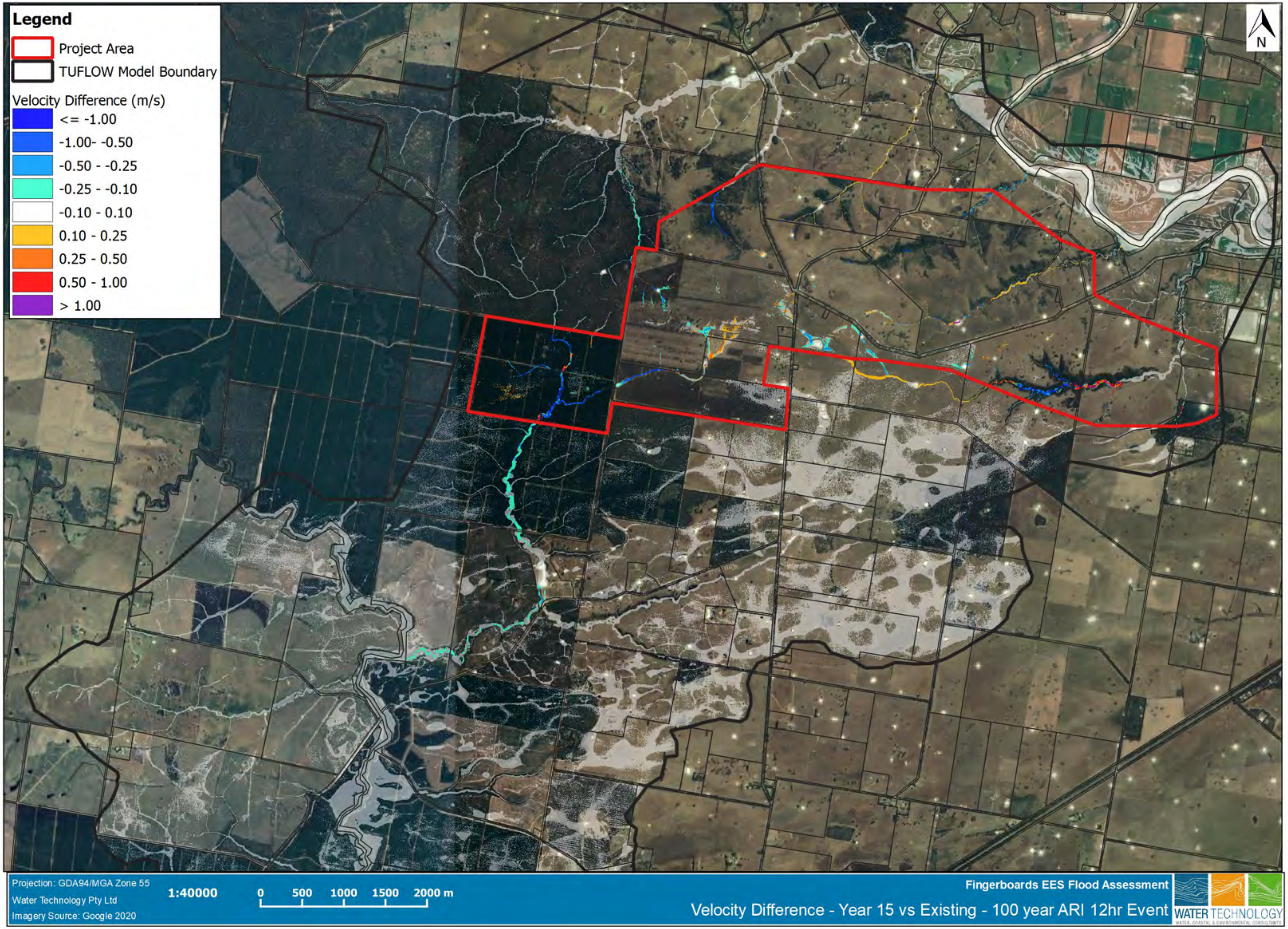

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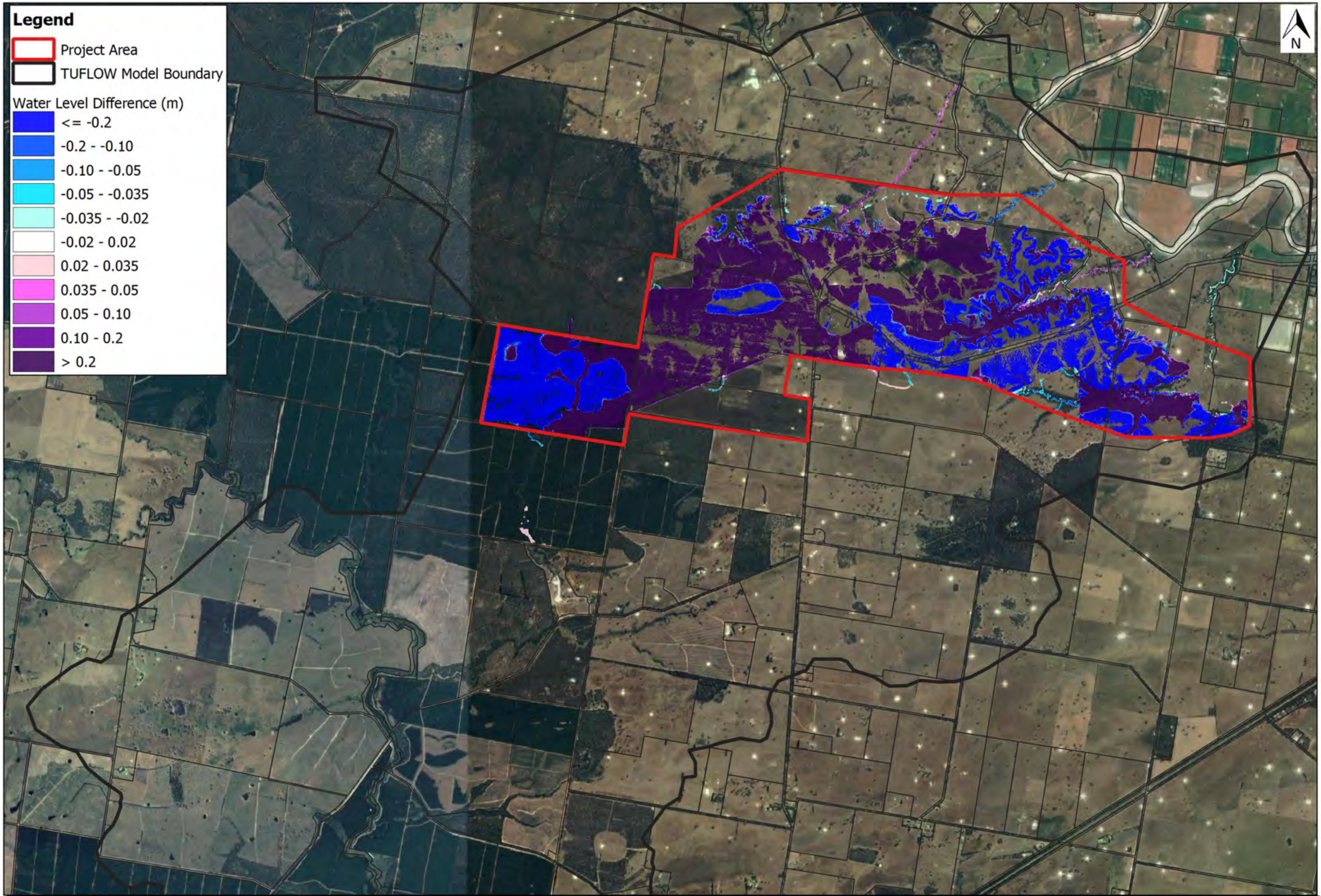

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Rehab vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY

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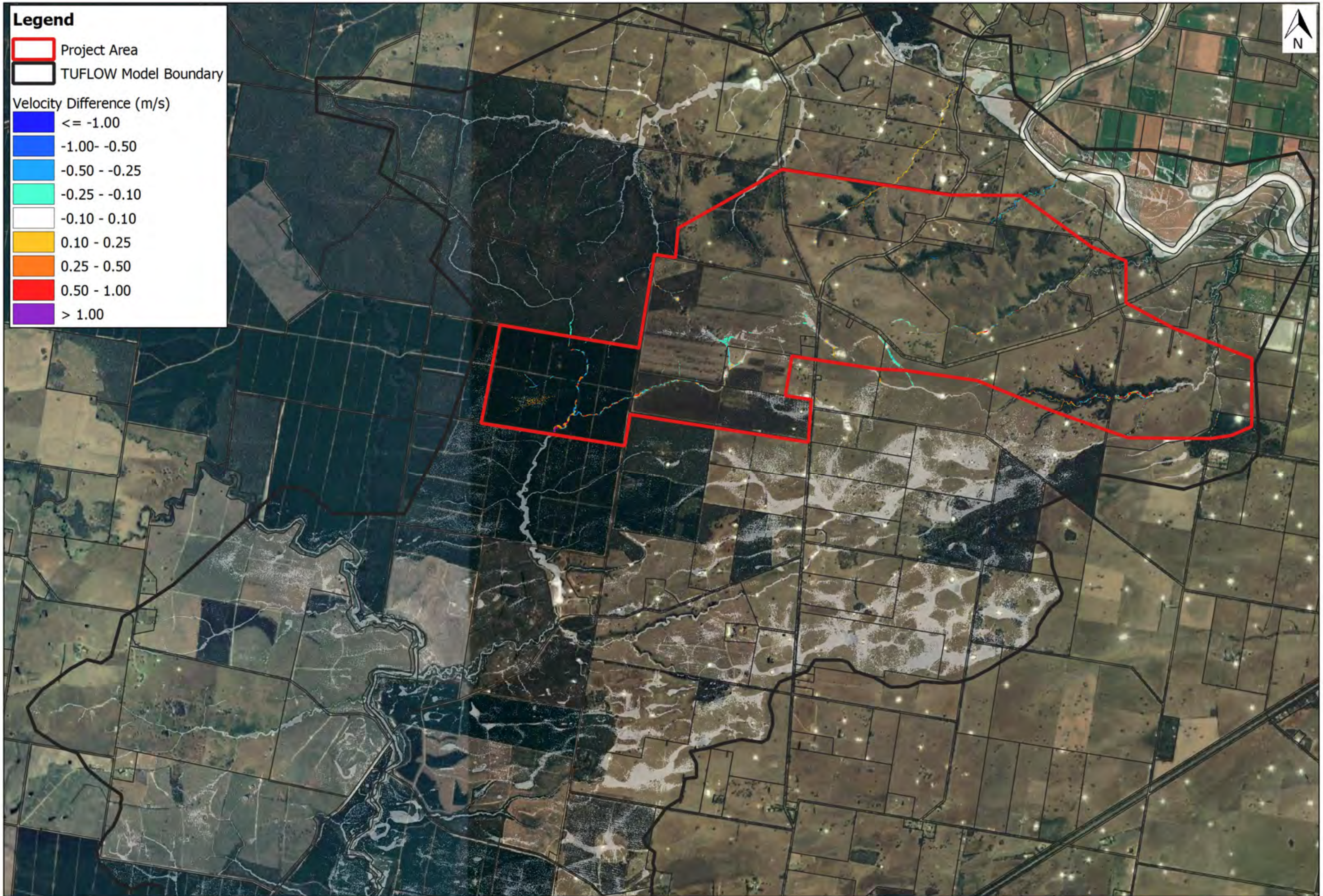

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Velocity Difference - Rehab vs Existing - 2 year ARI 9hr Event

WATER TECHNOLOGY

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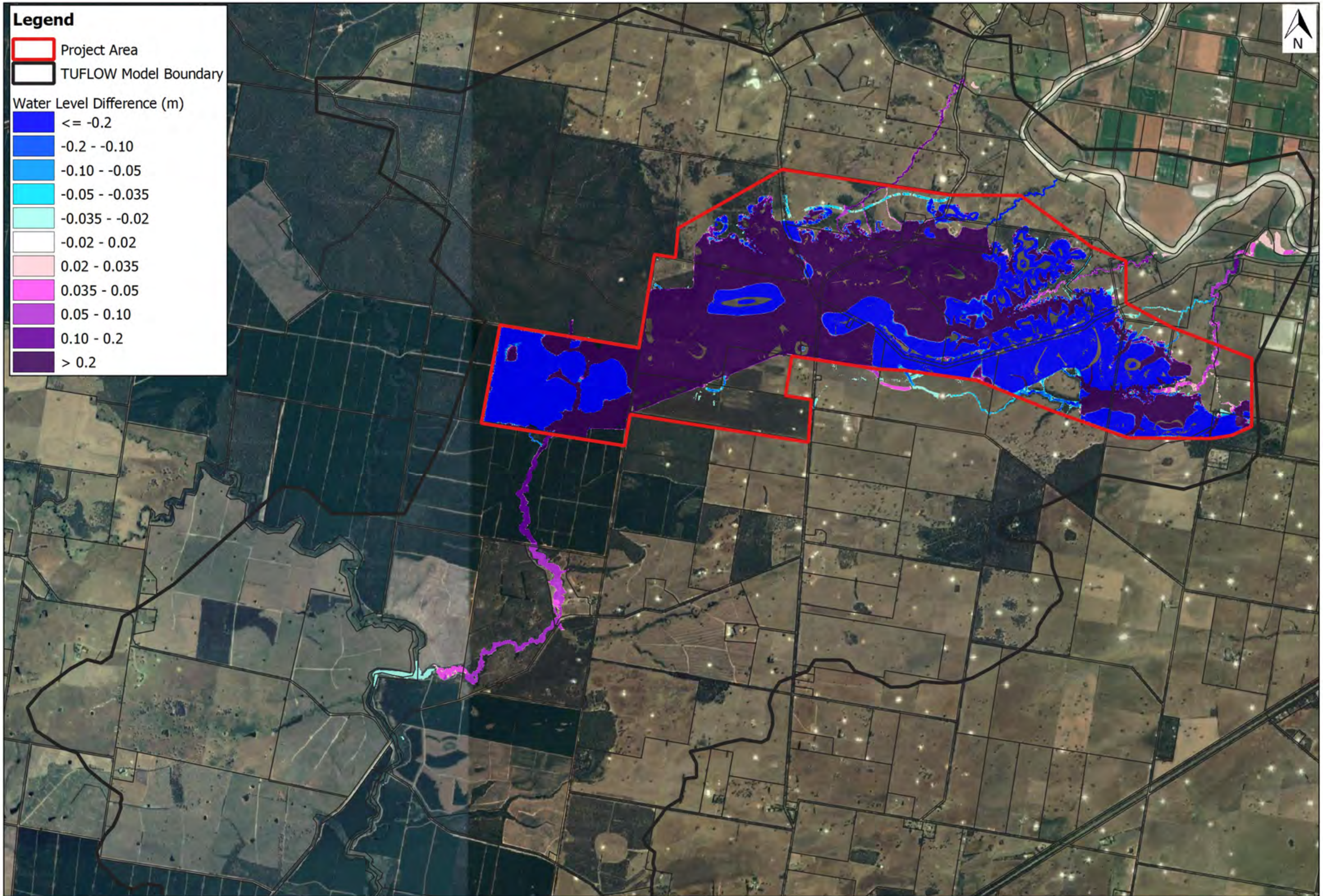

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Water Level Difference - Rehab vs Existing - 100 year ARI 1hr Event

WATER TECHNOLOGY

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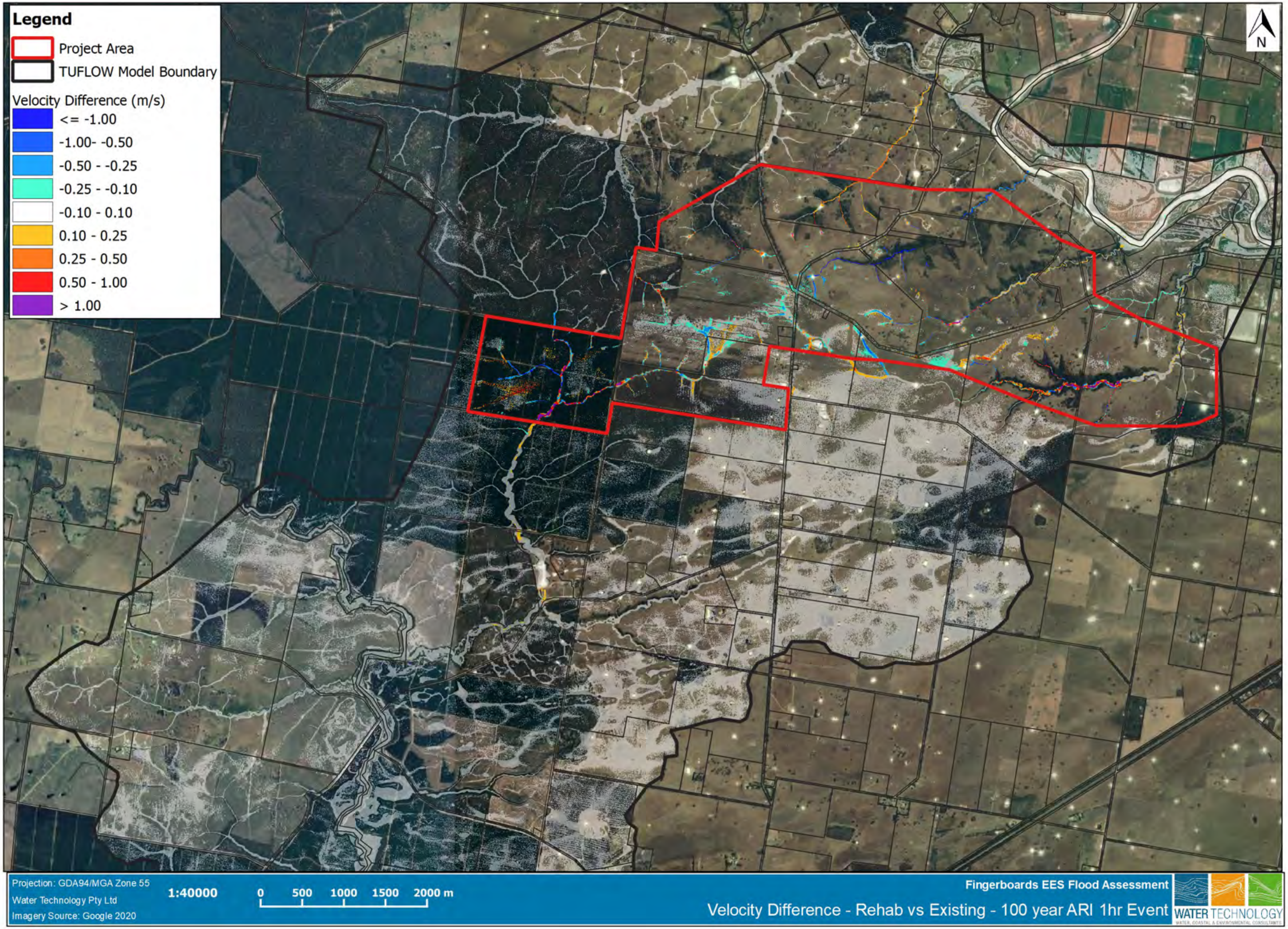

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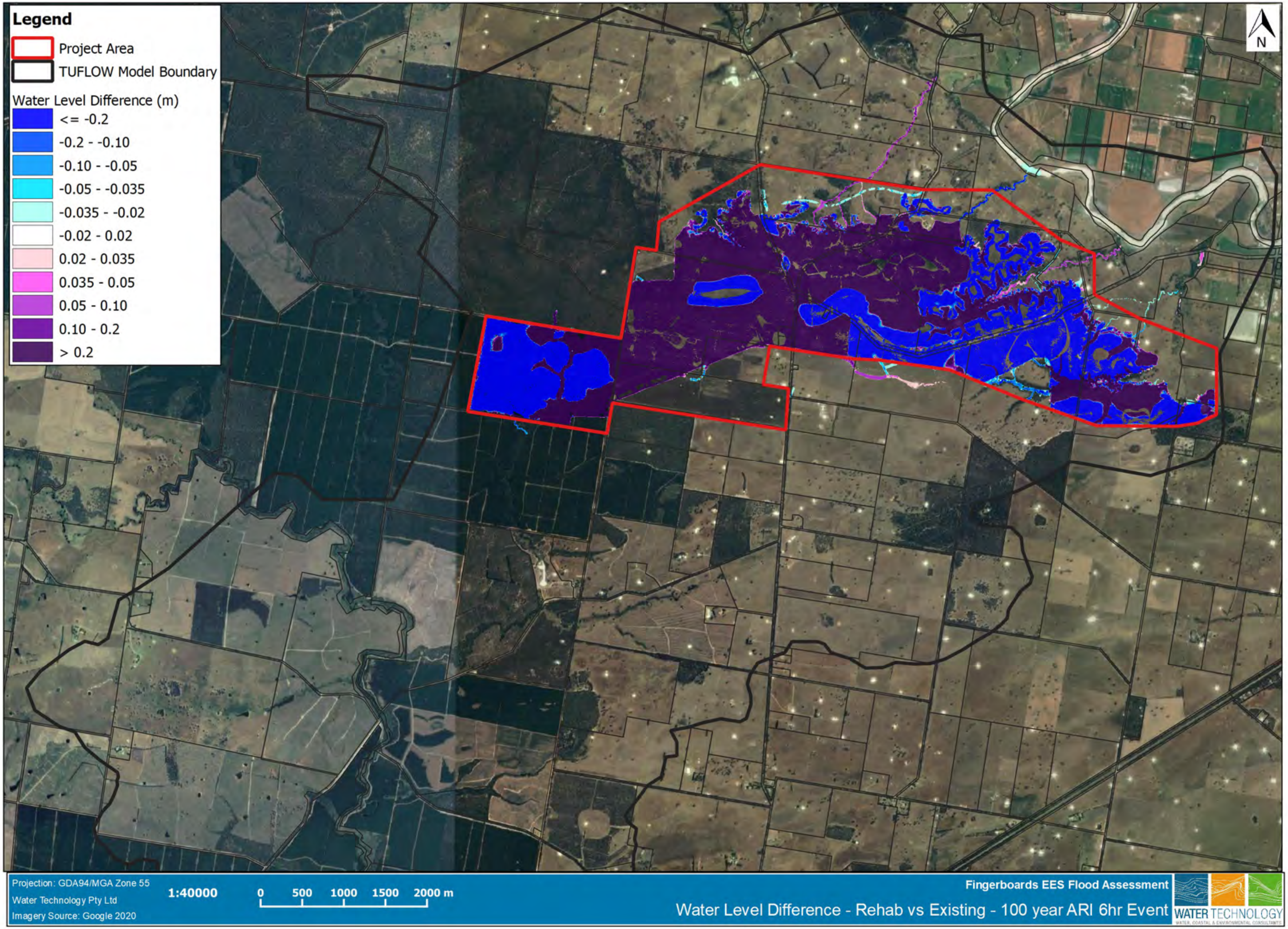

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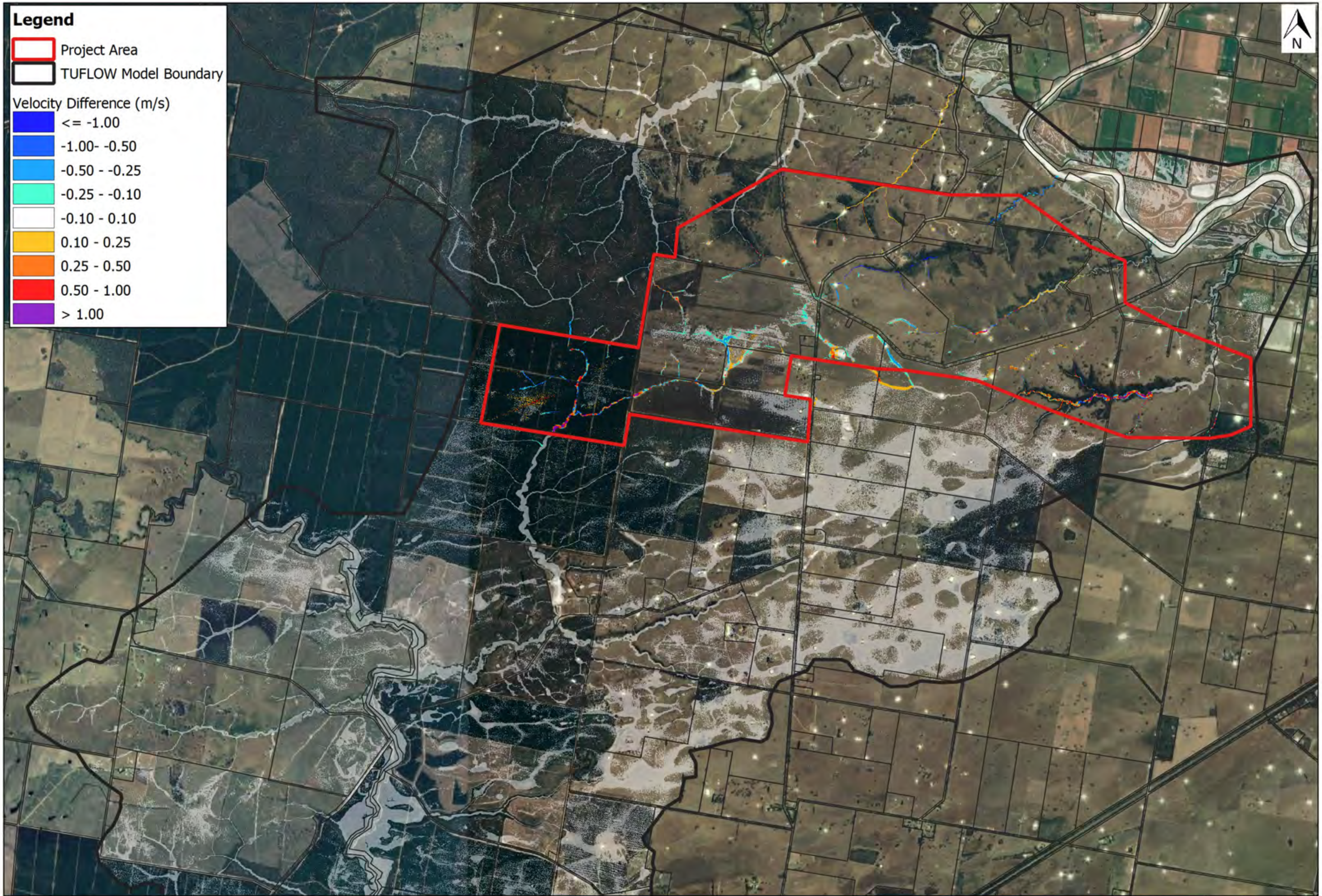

Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

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Fingerboards EES Flood Assessment

Velocity Difference - Rehab vs Existing - 100 year ARI 6hr Event

WATER TECHNOLOGY

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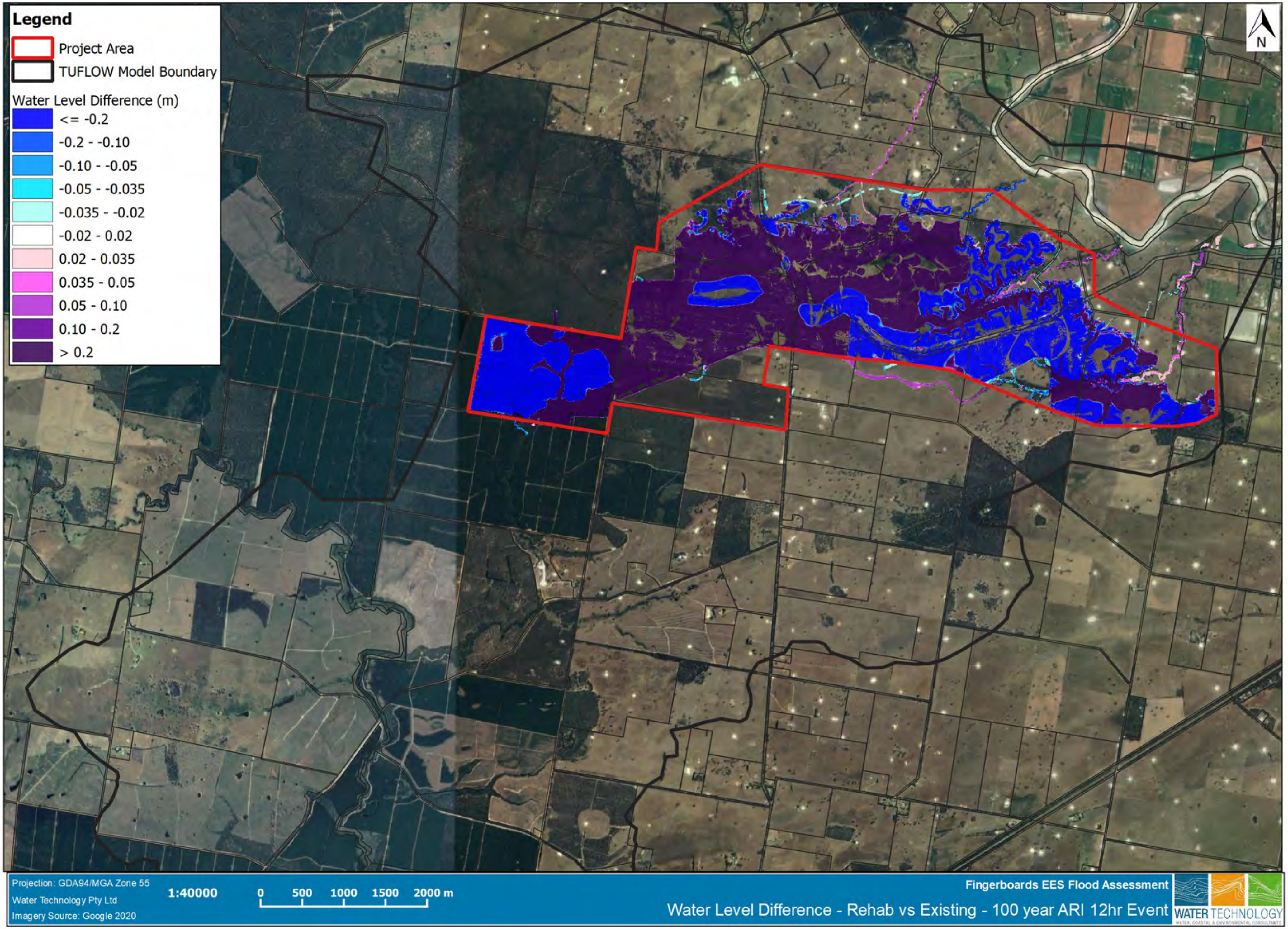
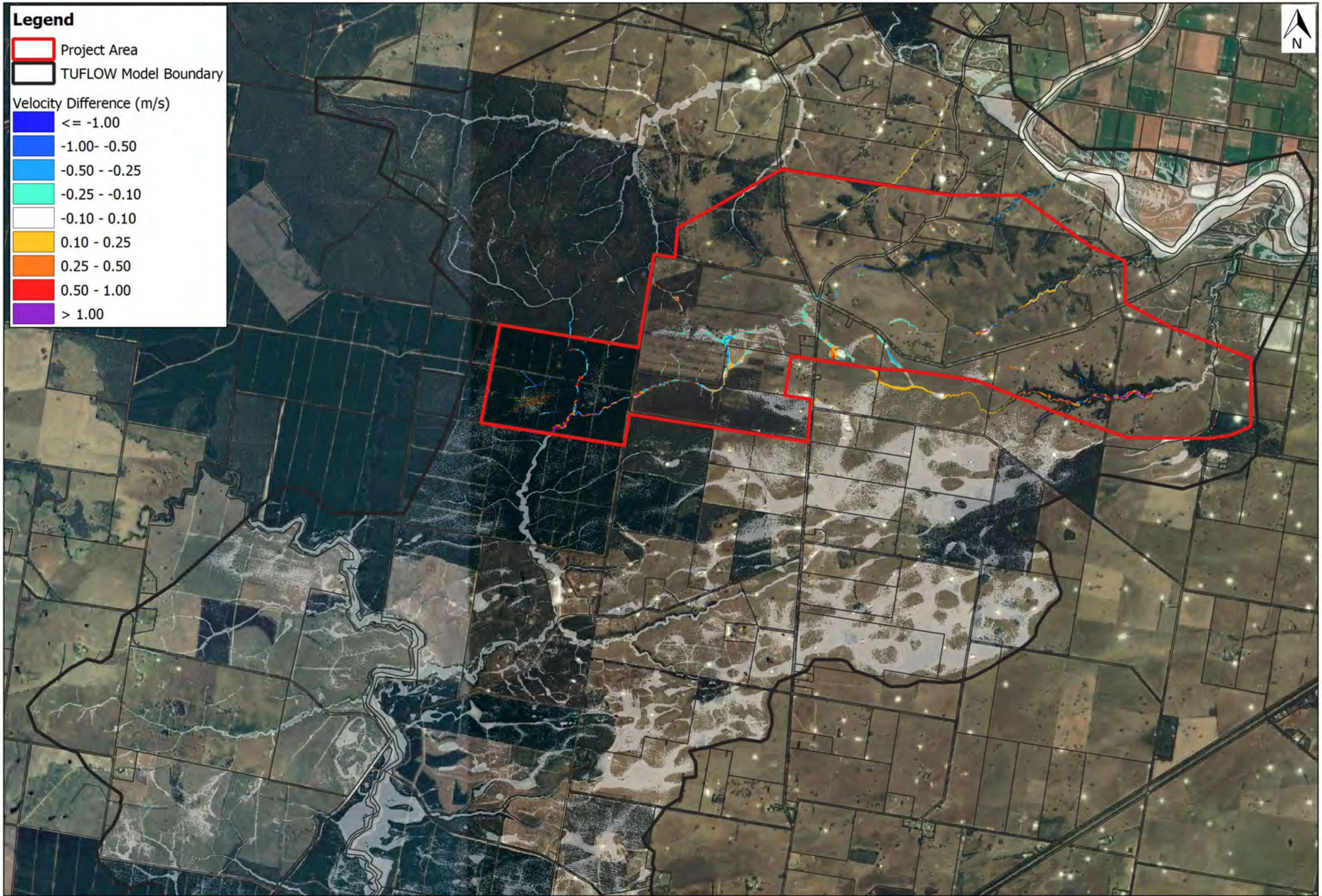


Legend
Project Area
TUFLOW Model Boundary
Water Level Difference (m)
<= -0.2
-0.2 - -0.10
-0.10 - -0.05
-0.05 - -0.035
-0.035 - -0.02
-0.02 - 0.02
0.02 - 0.035
0.035 - 0.05
0.05 - 0.10
0.10 - 0.2
> 0.2
N
Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020
1:40000
0 500 1000 1500 2000 m
Fingerboards EES Flood Assessment
Water Level Difference - Rehab vs Existing - 100 year ARI 12hr Event
WATER TECHNOLOGY
020-11-28T12:56:35.165



Projection: GDA94/MGA Zone 55
Water Technology Pty Ltd
Imagery Source: Google 2020

1:40000

0 500 1000 1500 2000 m

Fingerboards EES Flood Assessment

Velocity Difference - Rehab vs Existing - 100 year ARI 12hr Event

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

020-11-28T12:56:42.765

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

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Wangaratta

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Wangaratta VIC 3677
Telephone (03) 5721 2650

Perth

PO Box 362
Subiaco WA 6904
Telephone 0407 946 051

Geelong

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Geelong VIC 3220
Telephone 0458 015 664

Gippsland

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Bairnsdale VIC 3875
Telephone (03) 5152 5833

Wimmera

PO Box 584
Stawell VIC 3380
Telephone 0438 510 240

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info@watertech.com.au

Statement_James_Weidmann.docx