

**PRESERVING NAVIGATIONAL CHANNEL DEPTH
AT THE BATANG ARAU FLOODWAY MOUTH,
PADANG, WEST SUMATRA, INDONESIA:
A NUMERICAL STUDY OF JETTY LAYOUT
EFFECTIVENESS**

ENGINEERING REPORT

**MAS MERA
NBP. 25 4 161 2 061**



**PROFESSIONAL ENGINEER EDUCATION PROGRAM
POSTGRADUATE SCHOOL
UNIVERSITY OF ANDALAS
PADANG
2025**

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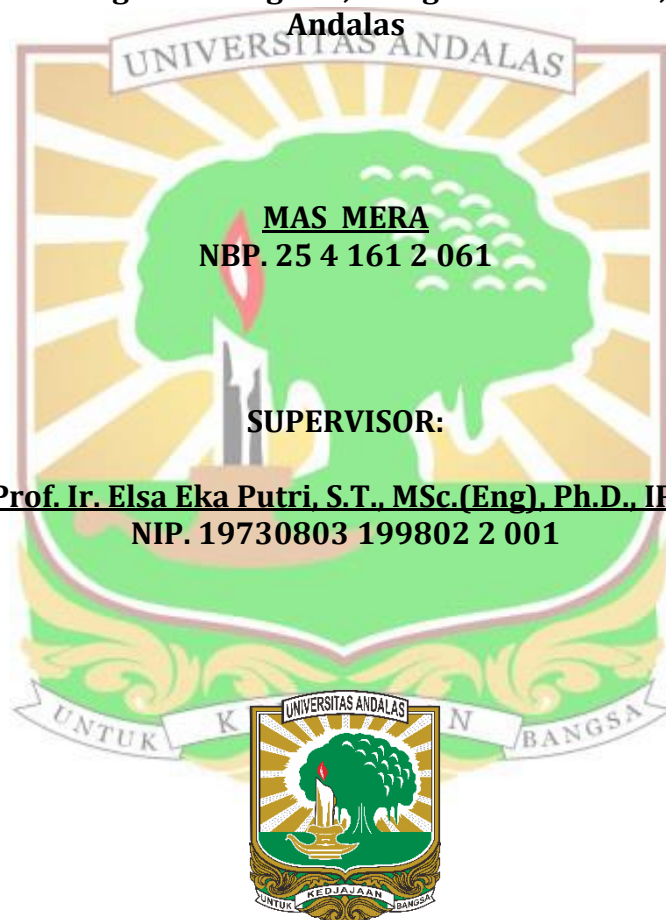
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ENGINEERING REPORT

**Submitted to fulfill One of the requirements for completing the study in
the Professional Engineer Program, Postgraduate School, University of
Andalas**



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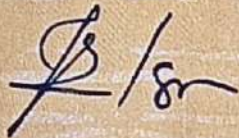
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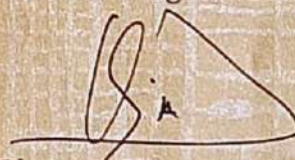
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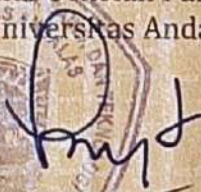
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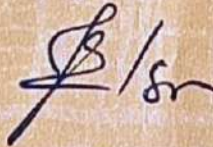
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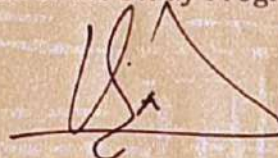
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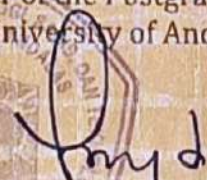
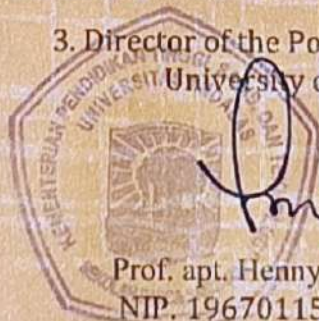
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Judul Laporan Teknik : Preserving Navigational Channel Depth at the
Batang Arau Floodway Mouth, Padang, West
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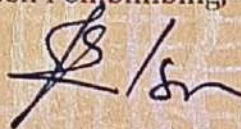
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the Batang Arau Floodway Mouth, Padang,
West Sumatra, Indonesia: A Numerical
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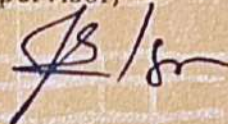
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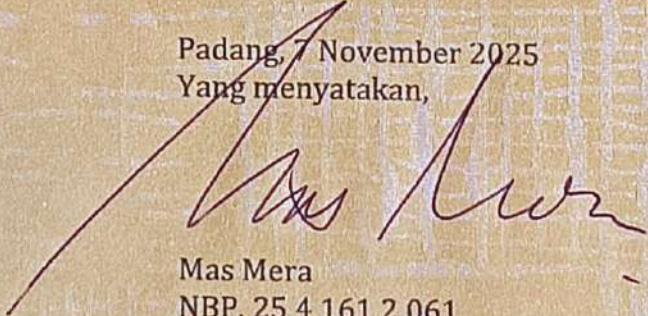
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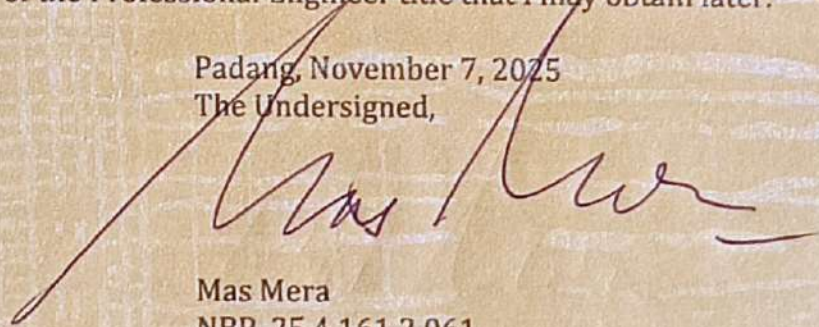
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ABSTRAK

Sedimentasi di wilayah pesisir menimbulkan ancaman kritis terhadap perekonomian perikanan setempat dan keselamatan navigasi, sehingga menuntut adanya solusi rekayasa yang efektif. Di muara Kanal Banjir (*floodway*) Batang Arau di Padang, Sumatera Barat, Indonesia, sedimentasi signifikan menghambat operasional kapal penangkap ikan dengan panjang melebihi 10 meter, meskipun sudah terdapat struktur *jetty* eksisting. Penelitian ini berfokus pada optimasi konfigurasi tata letak *jetty* untuk memitigasi sedimentasi dan meningkatkan kedalaman alur navigasi di muara Kanal Banjir ini menggunakan pendekatan simulasi numerik.

Sebanyak enam skenario tata letak *jetty* yang berbeda—termasuk skenario dasar (*baseline*), konfigurasi eksisting, dan empat desain optimasi yang diusulkan—disimulasikan dan dianalisis untuk mengevaluasi efektivitasnya. Simulasi hidrodinamika dan perpindahan sedimen kami, yang menggabungkan aksi gelombang spektral, dievaluasi berdasarkan stabilitas kedalaman alur (yaitu, sedimentasi atau erosi mendekati nol) dan kestabilan luas penampang melintang navigasi, menunjukkan bahwa Skenario 5—yaitu *jetty* kanan lurus pendek dikombinasikan dengan *jetty* kiri panjang kemudian miring 66° ke kanan—menawarkan perlindungan paling efektif terhadap pengaruh gelombang dan proses sedimentasi. Konfigurasi ini secara konsisten menghasilkan kedalaman alur yang stabil dengan hampir tidak ada sedimentasi atau erosi bersih (*no net sedimentation or erosion*) di muara dan di dalam alur utama, sehingga kedalaman navigasi dapat dipertahankan.

Peningkatan kinerja ini terutama disebabkan oleh pengaruh dominan arus sejajar pantai yang mengalir ke arah barat laut, konsisten dengan perpindahan sedimen sepanjang pantai yang didorong oleh gelombang di wilayah tersebut. Lebih lanjut, simulasi yang menggabungkan skenario pengerukan Kanal Banjir dalam kondisi debit normal maupun banjir menunjukkan bahwa upaya pengerukan yang substansial diperlukan untuk mencapai dan

mempertahankan kedalaman air yang memadai bagi lintasan aman kapal penangkap ikan yang lebih besar. Simulasi lanjutan yang dilakukan setelah pengerukan menunjukkan laju sedimentasi yang relatif rendah di dalam alur navigasi yang dikeruk, mengisyaratkan potensi peningkatan kenavigasian jangka panjang.

Kata kunci: Kanal Banjir pantai, Optimisasi tata letak, simulasi numerik, perpindahan sedimen, Kedalaman alur



ABSTRACT

This sedimentation poses a critical threat to the local fishing economy and safe navigation, necessitating effective engineering solutions. At the Batang Arau Floodway Mouth in Padang, West Sumatra, Indonesia, significant sedimentation impedes the operation of fishing vessels exceeding 10 m in length, despite the presence of existing jetty structures. This study investigates the optimization of jetty layout configurations to mitigate sedimentation and enhance the navigational channel depth at this coastal floodway mouth using a numerical simulation approach. Six distinct jetty layout scenarios, including a baseline, the existing configuration, and four proposed optimized designs, were simulated and analysed to evaluate their effectiveness. Our hydrodynamic and sediment transport simulations, incorporating spectral wave action, evaluated by the stability of channel depth (i.e., near-zero sedimentation or erosion) and maintenance of navigational cross-sectional area, reveal that Scenario 5—featuring a short straight right jetty combined with a long-left jetty angled 66° rightward—offers the most effective protection for the floodway mouth against wave action and sedimentation. This configuration consistently yields a stable floodway channel depth with almost no net sedimentation or erosion at the mouth and within the main channel, thereby preserving navigational conditions. This enhanced performance is primarily attributed to the dominant influence of the alongshore current flowing towards the northwest, consistent with the prevailing wave-driven longshore transport in the area. Furthermore, simulations incorporating a floodway dredging scenario under both normal and flood discharge conditions indicate that substantial dredging efforts are necessary to achieve and maintain adequate water depths for the safe passage of larger fishing vessels. Subsequent simulations conducted after the simulated dredging demonstrate a relatively low rate of sedimentation within the dredged navigation channel, suggesting the potential for a long-term improvement in navigability.

Keywords: Coastal Floodway, Jetty Optimization, Numerical Simulation, Sediment Transport, Channel Depth



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