



Fig. 18 The fifth scenario: The longitudinal section of Batang-Pangian Hilir and its water depth based on the simulation result

IV. CONCLUSIONS

The five scenarios of simulation result that straightening the trace or the river normalization is not effective in overcoming the flood in the Batang-Takung downstream. By making an additional intersection located about 1762 m downward of the existing intersection, of course by making an additional trace for Batang-Pangian Hulu, the flood in the Batang-Takung downstream could be solved.

The existing intersection is the cause of the backwater phenomenon in the Batang-Takung downstream. So, it can be said that the backwater is the main cause of the flood in Batang Takung. The other advantage of the additional intersection is the additional trace of the downstream of Batang-Pangian Hulu becoming straight. Consequently, the flow rate will be faster than the previous one. The increase of the flow rate will decrease the water depth.

REFERENCES

[1] H. Cai, H. H. G. Savenije, C. Jiang, and Q. Yang, "Analytical approach for determining the mean water level profile in an estuary with substantial fresh water discharge", *Hydrology and Earth System Sciences*, 20, p1177-1195, 2016.

[2] B. Hu, Z. Yang, H. Wang, X. Sun, N. Bi, and G. Li, "Sedimentation in the Three Gorges Dam and the future trend of Changjiang (Yangtze River) sediment flux to the sea", *Hydrology and Earth System Sciences*, 13, p2253-2264, 2009.

[3] L. L. Wang, Z. Z. Yu, H. C. Dai, and Q. H. Cai, "Eutrophication model for river-type reservoir tributaries and its applications", *Water Sciences and Engineering*, 2(1), p16-24, 2009.

[4] A. C. Costa, A. Bronstert, and J. C. de Aroujo, "A channel transmission losses model for different dryland rivers", *Hydrology and Earth System Sciences*, 16, p1111-1135, 2012.

[5] L. Tang, W. Zhang, M. X. Xie, and Z. Yu, "Application of equivalent resistance to simplification of Sutong Bridge piers in tidal river section modeling", *Water Sciences and Engineering*, 5(3), p316-328, 2012.

[6] Y. Fan, "Application of 2-D sedimen model to fluctuating backwater area of Yangtze River", *Water Sciences and Engineering*, 2(3), p37-47, 2009.

[7] K. Lee, A. R. Firoozfar, and M. Muste, "Technical Note: Monitoring of unsteady open channel flows using the continuous slope-area method", *Hydrology and Earth System Sciences*, 21, p1863-1874, 2017.

[8] PSDA, *Laporan Survey Investigasi Desain Batang Pangian Kabupaten Sijunjung*, Dinas Pengelolaan Sumber Daya Air Provinsi Sumatera Barat, Padang, 2013.

[9] M. Mera, *Hidrolika Saluran-terbuka*, CV. Ferila Padang, 210p, ISBN: 978-602-9081-03-9, 2010.

[10] M. Mera, R. Hardianti, M. Riondy, and R.D.B. Putra, "Effects of Cross-Sectional Geometry of Prismatic Reaches on the Manning Coefficients", *International Journal of Civil Engineering & Technology (IJCIET)*, 8(10), p677-686, 2017.

[11] J. S. Kim, C. J. Lee, and Y. J. Kim, "Roughness coefficient and its uncertainty in gravel bed river", *Water Sciences and Engineering*, 3(2), p217-232, 2010.

[12] K. v. d. Wiel, S. B. Kapnick, G. j. v. Oldenborgh, K. Whan, S. Philip, G. A. Vecchi, R. K. Singh, J. Arrighi, and H. Cullen, "Rapid attribution of the August 2016 flood-inducing extreme precipitation in south Louisiana to climate change", *Hydrology and Earth System Sciences*, 21, p897-921, 2017.

[13] K. Lee, A. R. Firoozfar, and M. Muste, "Technical Note: Monitoring of unsteady open channel flows using the continuous slope-area method", *Hydrology and Earth System Sciences*, 21, p1863-1874, 2017.

[14] M-J. Um, Y. Kim, D. Park, and J. Kim, "Effects of different reference periods on drought index (SPEI) estimations from 1901 to 2014", *Hydrology and Earth System Sciences*, 21, p4989-5007, 2017.

[15] W. Liu, F. Sun, Y. Li, G. Zhang, Y-F. Sang, W. H. Lim, J. Liu, H. Wang, and P. Bai, "Investigating water budget dynamics in 18 river basins across the Tibetan Plateau through multiple dataset", *Hydrology and Earth System Sciences*, 22, p351-371, 2018.

[16] M. Hartnett, and S. Nash, "High-resolution flood modelling of urban areas using MSN-Flood", *Water Sciences and Engineering*, 10(3), p175-183, 2017.

[17] H. Hidayat, B. Vermeulen, M. G. Sassi, P. J. J. F. Torfs, and A.J.F. Hoiting, "Discharge estimation in a backwater affected meandering river", *Hydrology and Earth System Sciences*, 15, p2717-2728, 2011.