

NSA Inc comments on the ‘Baramul’ NSF Study

The Australian Research Council/Southern Cross University Linkage study was very helpful in confirming the benefits of NSF in-stream structures for improved river health and environmental outcomes.

In particular, NSF was strongly endorsed for:

1. Forming pools and riffles¹ in straight, sand bed streams (like Widden Brook) and causing bed armouring².
2. Assisting in the reduction in the width of the stream channel;
3. Providing a seed bed for the re-colonisation of River She-Oak, *Casuarina cunninghamiana*
4. Keeping the salt levels in the stream and adjacent floodplain at an acceptable level;
5. Reconnecting the stream water and groundwater in alluvial and floodplain sediments;
6. Providing habitat for macro-invertebrates, by creating permanent pools;... and
7. (In Summary) **“Baramul NSF stream works have facilitated sand storage, vegetation recovery and localised channel floodplain hydrological exchange, important for pool/riffle development, channel contraction and hyporheic³ function”**

The ARC linkage project, LP0455080, is titled, *”Restoring hydrological connectivity of surface and groundwaters: Biogeochemical processes and environmental benefits for river landscapes.”*

A number of quotes from the report are worth mentioning, e.g.

“Residual pool depths at “cease-to-flow in 2007 were considerably greater than in 2004 and hence prior to the commencement of river rehabilitation (i.e. before the project started).

These pools now store four times the volume of water than in 2004. This represents greater geomorphic complexity and a substantial increase in aquatic habitat.”

AND

“Sand was sequestered in bars and benches, and stabilised by vegetation colonisation, facilitated by the presence of a series of in-stream structures” i.e., leaky weirs or litter barriers.

AND

“The EC⁴ (electrical conductivity and hence salinity) of groundwater stored in the alluvial aquifer tended to be greater the further away from the structures. This suggests that the structure itself may be reducing EC values between the stream water and groundwater by promoting localised hydrological exchange⁵.” *(for this read, interaction between the stream water and the groundwater)*

AND

“The alluvial groundwater storage of the floodplain was important for maintaining base flow conditions.” *(for this, read a constant trickle even in dry times)*

AND

“Results from autumn 2005 (drought sampling) identify that an NSF pool site has more Taxa (classes of organisms)– than the model prediction.”

“Potential explanations include:

That the NSF site has created a refugium⁷ environment and hence is drought “proofing” the Widden Brook?

Is the created habitat inconsistent with that which could be typically found in the Widden catchment and hence a new artificial environment has been created? or

Has the AUSRIVAS* (Australian River Assessment System) assessment model got it wrong?”

There are a couple of comments that are at odds with Peter’s definitions. He talks about chains of ponds, while the scientific report says that there are virtually no chains of ponds in the Hunter region. Hence:

“NSF is not “re-creating” or “restoring” a chain of ponds system; however, NSF is providing geomorphic complexity. Widden Brook has been a continuous, active sand-dominated system through the Holocene⁸ period, and is presently a planform⁹, controlled, low sinuosity¹⁰, sand-bed stream in a partly confined valley setting.”

Similarly, the report warns of the dangers of salt mobilisation – with which Peter is already fully familiar.

“Where NSF structures or channels intersect well developed river terraces, salt mobilisation from groundwater is enhanced, impacting stream water, particularly under base flow conditions¹¹.”

The Report also stated, that **“NSF had no measurable affect on stream flow in Widden Brook.”** This is particularly relevant to the wider application of NSF in that:

This comment relates to the availability of water for downstream neighbours since this has been a concern among many farmers who believed that the installation of “leaky weirs” would reduce their water supply by retention of water in the pools behind them.

The ARC Study team also admits that a number of questions regularly raised by the general public and policy makers were outside the scope of this study.

“By far, the most common questions asked of our research project revolve around NSF, and how it has affected the landscape. Next are specific inquiries on how NSF was implemented and where it is likely to benefit the environment and agricultural productivity. Our research focussed on the NSF management and interventions within the river and immediately adjacent floodplain. Aspects of NSF involving the broader valley landscape and agricultural productivity have been practised at *Baramul*, but were beyond the scope of our investigations.”

This suggests perhaps that some items needing further study (see below).

The Report finished up by saying:

“The scientific research conducted within the ARC funded project has served to inform government agencies and the broader public through several technical field days at *Baramul*, organised by Natural Sequence Farming Foundation and endorsed by the National Steering Committee on NSF. These meetings would attract up to 80 landholders/environmental managers, providing an ideal opportunity to present the key research findings as they emerged. In addition, the research has played a critical role in informing the public debate on NSF, particularly through contributions to televised reports, radio commentary, invited presentations at national conferences and presentations to leading government agencies.”

The following recommendations were made in the Report that further studies were needed to resolve:

Interactions between enhanced surface water-groundwater connectivity¹² and riparian vegetation establishment and productivity;

Role of vegetation in the mid/longer term in stabilising rivers and improving water quality;

Longer term monitoring to improve the quantitative assessment of changes to water budgets, salt budgets and processes that mobilise salt in sandy alluvial landscapes;

Optimised (or “better”) design of weirs and structures for obstructing flow and sediments;

The microbial functions in the shallow groundwater dominated sediments, particularly the mobilisation of inorganic nutrients (e.g. P, Fe, Mn, N, K) in response to wetland establishment; and

Studies on the transferability of NSF through the trialling of NSF in a far broader range of Australian landscapes.

This is the FIRST fully funded, independent, scientific Report that endorses many of the NSF approaches.

Glossary of terms

- 1 **Pools and riffles** = In a flowing stream, develops as a stream's hydrological flow structure alternates from areas of relatively shallow to deeper water. This sequence is present only in streams carrying gravel or coarser sediments. Riffles are formed in shallow areas by coarser materials such as gravel deposits over which water flows. Pools are deeper and calmer areas whose bed load (in general) is made up of finer material such as silt. Streams with only sand or silt laden beds do not develop the feature. The sequence within a stream bed commonly occurs at intervals of from 5 to 7 stream widths. Meandering streams with relatively coarse bed load tend to develop a riffle-pool sequence with pools in the outsides of the bends and riffles in the *crossovers* between one meander to the next on the opposite margin of the stream. The pools are areas of active erosion and the material eroded tends to be deposited in the riffle area between. (A riffle is a mini-rapid formed at each step in the streambed where the fall in the stream is relatively steep. Behind the riffle there is a pool, held in place by an impermeable rock shelf, a thatch of reeds/sedges, or in this case by a newly vegetated leaky weir).
- 2 **Bed armouring:** is any material used to armor shorelines, streambeds and other shoreline structures against scouring by water.
- 3 **Hyporheic function:** This is the mixing of shallow groundwater and surface water. The hyporheic zone is a region beneath and lateral to a streambed.
- 4 **EC:** Electrical Conductivity, which measures salinity in p.p.m.,
- 5 **localised hydrological exchange:** the interchange of water from the stream to the groundwater & back but only in the immediate vicinity of the watercourse (largely the interbank zone or stream bank full zone).
- 6 **Refugium:** habitat where organisms can seek shelter
- 7 **AusRivas** is the Australian Rivers Assessment System. The development of AusRivAS Assessment Manual has been a national effort under the National River Health Program (NRHP)
- 8 **Holocene:** *The Holocene is a geological period, which began approximately 12,000 years ago. According to traditional geological thinking, the Holocene continues to the present day.*
- 9 **Planform** *The outline or shape of a body of water as determined by the stillwater line OR stable in its natural architecture – i.e. the way it flows, its features etc.*
- 10 **low sinuosity** means a lack of meandering

- 11 **base flow conditions** refers to water flows during low rainfall periods
- 12 **surface water-groundwater connectivity** refers to water flows during low rainfall periods

Part of this Report is reproduced at Southern Cross University webpage
<http://www.scu.edu.au/geoscience/index.php/12/>

REFERENCE:

Bush, R., Keene, A., et al., ARC Linkage-Project, Final Report to Industry Partners for LPO455080, *Restoring hydrological connectivity of surface and groundwaters: Biogeochemical processes and environmental benefits for river landscapes*.
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