# North Pine Dam Optimisation Study

## Discussion Paper

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# Background of NPDOS

North Pine Dam is located on the North Pine River in the suburb of Petrie and sits within the Moreton Bay Regional Council Area. The dam has a water supply volume of 214,302 megalitres and has a catchment area of approximately 345 $km^2$. Owned and operated by Seqwater, the North Pine dam is one of the 12 key water supply storages for South East Queensland.

The January 2011 flood is the largest recorded flood in the North Pine River since records commenced in 1916. The heavy rainfall that occurred during the January 2011 flood event also produced major floods in the Brisbane River Basin and other river systems across Queensland.

In the lead up to the January 2011 flood event Seqwater made many releases, however, the bulk of releases were made over a 14 hour period on Tuesday 11 January 2011. These were the largest releases to have been made by the dam in its history.

In response to the widespread flooding that occurred in 2010–11, the Queensland Floods Commission of Inquiry (QFCoI) was established to review all aspects of flood events across Queensland. In March 2012 the QFCoI Final Report was released and 177 recommendations were put forward and endorsed by the Queensland government. The North Pine Dam Optimisation Study (NPDOS) has been undertaken by the Department of Energy and Water Supply in response to recommendations 17.3 and 17.9 of the QFCoI final report.

In particular, recommendation 17.9 states that the Queensland Government considers whether North Pine Dam should be operated as a flood mitigation dam.

Following completion and reporting on the technical studies and consideration of the feedback from community consultation and the completion of the study, the Queensland Government will make a decision (anticipated by the end of 2014) on the best balance for the future operations of North Pine Dam.

# Aim of this Discussion Paper

The Queensland Government has publicly released the North Pine Dam Optimisation Study (NPDOS Report). This discussion paper has been developed as a guide to understanding the more technical NPDOS Report. The NPDOS Report is the primary document about the study.

The Queensland Government is seeking your feedback on all of the operational options for the dam that are presented in the NPDOS Report. NPDOS investigated a range of alternative operational options for how North Pine Dam might be operated in the future. The Government is particularly interested in the option for a semi-permanent lowering of North Pine Dam to 90% of its current water supply level.

This discussion paper will not only act as a guide to interpreting the meaning of each option, but also outline the overall findings of the final report.

# Key Concepts

## Water Supply Dams

North Pine Dam was designed and constructed as a water supply dam. Wivenhoe Dam, unlike the much smaller North Pine Dam, was designed and constructed for the dual purpose of water supply and flood mitigation. North Pine Dam was not designed to be operated as a flood mitigation dam.

## Flood Mitigation and Full Supply Volume / Level

The maximum amount allowed to be stored in North Pine Dam for water supply purposes is called the “full supply volume”, or “full supply level”. If the water in the dam goes over the full supply volume then the dam operators must release the extra water. When this release is made it is called a flood release.

North Pine Dam also has some space above the full supply level for flood water storage that is kept empty in case of a flood. This flood water space is not used to store our drinking water supply. The dam operators may temporarily use this space during a flood to help protect the dam from overtopping. The gates on North Pine Dam are also opened to release flood water to protect the dam from overtopping during a flood.

For a flood mitigation dam this release is at a much lower rate than the rate of the floodwater flowing into the dam. As discussed earlier, North Pine Dam is not designed or constructed to be a flood mitigation dam and therefore the dam is only able to temporarily store water above the full supply level to hold back some of the floodwaters. This floodwater is then released at the same rate as the floodwater flowing into the dam.

Flood mitigation dams, such as Wivenhoe Dam, keep a large amount of the overall dam volume empty so that flood waters can be held back to mitigate flooding downstream of the dam and in addition keep a large amount of space available to prevent the dam from overtopping. Since North Pine Dam is a water supply dam, it was not designed to have enough space to also provide significant flood mitigation.

If North Pine Dam was to also operate as a flood mitigation dam, a lot less of our water supply could be stored in the dam on a day to day basis. In technical terms, this would mean permanently lowering the full supply volume.

# The options

Only three things can be changed in the way North Pine Dam is operated: (1) how much of our water supply is stored in the dam (full supply volume); (2) the water level height that triggers the opening of the gates to release floodwater and (3) the rate at which the gates are opened. These changes may also be temporary (i.e. seasonal), semi-permanent or permanent.

The study tested eight different ways of operating the dam to see how changing the three factors in various combinations affected the performance of the dam (see Table 1.1 below). The tests consisted of four different full supply volumes (100%, 85%, 75% and 42%), each with different triggers for when floodwater would be released as well as various gate opening rates.

For example, one of the tests was to see if the dam performs better if the full supply volume is set to 85% and floodwater is released as soon as the water level in the dam went over the 85% level, or if the dam performed better when the full supply level was set to 85% and floodwater is released when the water level in the dam reached 100%. The rate at which the gates were opened was also factored in to determine an optimised performance.

One test was done to see how the dam performed as if no gates were on the spillway. To test this, the full supply volume was lowered to 42%. This is the level that corresponds to the top of the concrete spillway. The results of this test allowed the study to determine what impacts occur downstream if there was no control over how water is released during a flood event.

Each of the tests in Table 1.1 can be summed up in three main options as follows:

- Option 1 – Maintaining the existing way the dam is operated,
- Option 2 – Lowering the full supply volume but keeping the existing gate opening trigger level for flood releases, and
- Option 3 – Lowering the full supply volume and also lowering the gate opening trigger levels.

The eight tests were specially undertaken to gain an understanding of how flooding, water security, transport, dam safety and overall impacts were affected by the operations of the dam. There is capacity, however, to consider options which lie in between the various full supply volumes and to look at how these might be carried out in the short or long term. The preferred option of lowering the full supply volume to 90% is one of these in between options.

All the tests undertaken for the study were completed using model simulations. A range of different flood events were tested from very small floods to the largest conceivable flood that could occur within the catchment. The range of flood events used in the modelling were simulated floods except for the five largest real floods. These five floods were January 1974, February 1999, March 1989, January 2011 and January 2013.

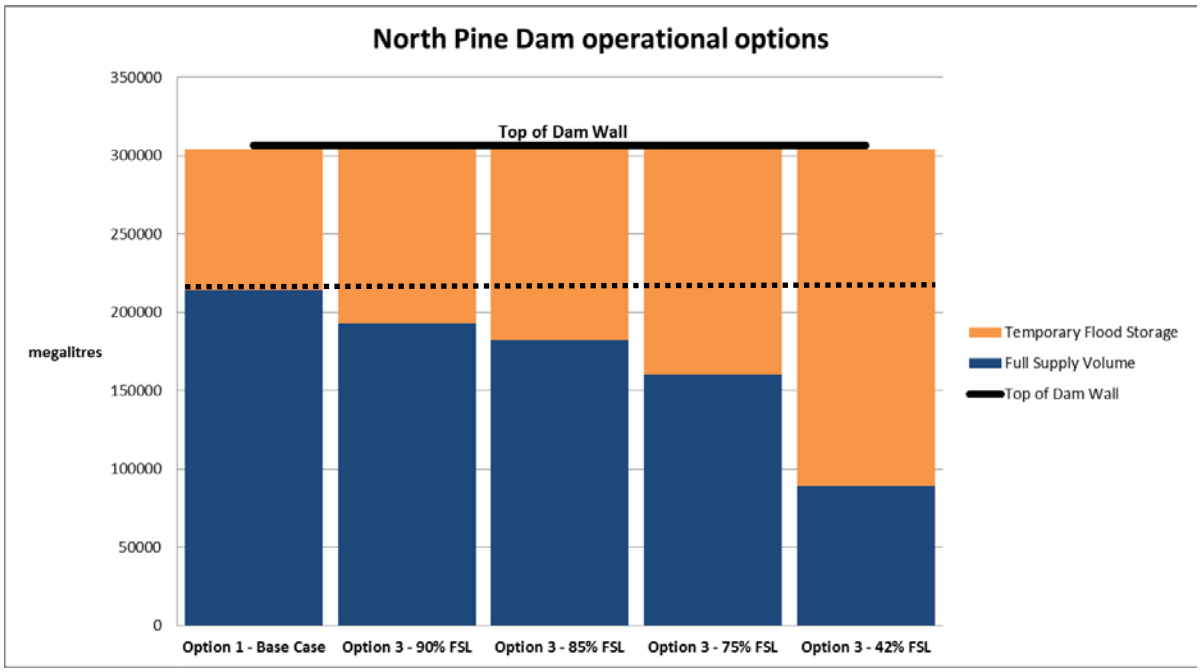
| Option | Dam Level | | Flood Release Level | | Description |
|---|---|---|---|---|---|
| | %FSV | m AHD | %FSV | m AHD | |
| 1 | 100 | 39.60 | 100 | 39.60 | Existing situation with the dam at its current full supply volume. |
| 2.1 | 85 | 38.04 | 100 | 39.60 | Lower dam level to 85% full supply volume with the flood release level at 100% full supply volume |
| 2.2 | 75 | 36.88 | 100 | 39.60 | Lower dam level to 75% full supply volume with the flood release level at 100% full supply volume |
| 2.3 | 42 | 32.004 | 100 | 39.60 | Lower dam level to 42% full supply volume with the flood release level at 100% full supply volume |
| 3.1 | 85 | 38.04 | 85 | 38.04 | Dam level and flood release level lowered to 85% full supply volume |
| 3.2 | 75 | 36.88 | 75 | 36.88 | Dam level and flood release level lowered to 75% full supply volume |
| 3.3 | 42 | 32.004 | 42 | 32.004 | Dam level and flood release level lowered to 42% full supply volume |
| No Gates | 42 | 32.004 | 42 | 32.004 | Gates lifted to the fully open position (that is, no gate control) |

**Table 1.1 – Eight Operational Alternatives**

# Key Findings

Option 3 offers some small improvements to flood mitigation over a range of flood events for all the lowered full supply levels that were assessed. Option 2 may only provide flood mitigation improvements over a range of smaller flood events similar to those experienced historically. The focus of the study then turned to what advantages and disadvantages Option 3 might have over Option 1.

The graph below of some options illustrates how making more space available for temporary floodwater storage means there is less space available for our water supply.




**Graph 1.1 Option 1 –Base Case and variations of Option 3 considered in the NPDOS report.**

Option 3 assessed how well the operations of the dam managed the following factors:

- urban flood inundation
- impacts on water supply security
- dam safety and flood warning
- impacts of submergence of bridges and crossings
- bank slumping and erosion, and riparian fauna and flora impacts.

The study assessed the overall advantages and disadvantages of the options to produce a score. This score is called the “net present costs” and effectively reduces benefits of every option down to a dollar figure to help comparisons. The net present costs are a guide that takes into account not only the impacts of floods, but also other impacts including those on our water supply.

The net present costs for Option 3 over the short term (20 years) are not as high as in Option 1; however the reverse applies over the medium term (40 years). Furthermore the analysis showed that lowering of the dam would have some economic benefits up to about 2035 and then an economic impact from 2035 to 2055.

In summary, lowering the full water supply volume of North Pine Dam is not beneficial on a long term basis because of the increased risk to our water supply. However, if the lowering is only semi-permanent (20 years) there is no such long term risk.

The preference is, therefore, for a lowering of the full supply volume to 90% for a maximum of 20 years as this has a better balance of short term benefits without the long term risks.

Also, the overall advantages and disadvantages of the semi-permanent, 90% full supply volume shows that it improves infrastructure protection by decreasing the probability of overtopping the dam crest during rare and extreme floods. This option also gives more time

for warning downstream residents and therefore more time for residents to act on the information they are given. Another advantage of the preferred option is that it has no impact in the overall south east Queensland context on water supply security in the medium to long term as it is only a relatively small reduction and is not permanent.

Seqwater has a dam improvement program for North Pine Dam, which is a staged program for undertaking changes to the way the dam is built to improve how the dam deals with rare and extreme flood events. This program is expected to be completed sometime between 2025 and 2035. The semi-permanent lowering of the full supply volume for the dam to 90% gives Seqwater further flexibility in the timing of delivery of the improvement program. The semi-permanent lowering to 90% of the full supply volume would likely not be needed after this program is completed.

# Moving Forward

The public consultation period provides the opportunity for community members and stakeholders to submit feedback on the North Pine Dam Optimisation Study.

We ask that you provide your thoughts on the report and the preferred options by submitting them online www.dews.qld.gov.au or emailing optimisationstudies@dews.qld.gov.au.

The consultation period closes on 30 June 2014.

Comments and feedback will be collated for consideration and assessment by the project team, and included in the final report due to be published in late 2014.