

Use Of C & S Filter Coal To Upgrade Existing Filters

Beacuase of the key importance of the filter media properties to the performance of a filter plant, it is feasible to upgrade the capacity and performance of a filter plant by changing the filter media. There are many examples where this has been done on full scale plants in Australia using C & S Filter Coal.

In some cases, mono media sand filters with a typical Effective Size of 0.5-0.7 mm and a high Uniformity Coefficient have been upgraded by installing C & S Filter Cola with an Effective Size in the range 1.0-1.3 mm and Uniformity Coefficient 1.3 maximum.

In other cases, an imported anthracite coal in dual media filters has been replaced by C & S Filter Coal with a more suitable (larger) Effective Size and a lower Uniformity Coefficient (1.3 maximum).

In several Australian plants, the conversion from sand media to coarser C & S Filter Coal has resulted in a several fold increase in filter run times and unit filter run volumes (UFRV's), with increases in maximum sustainable plant throughput rates of up to 45%, allowing the plants to operate consistently at their maximum hydraulic capacity.

These increases in filter performance provide the scope for significant capital cost savings by deferring the need to construct additional facilities, and for operating cost savings by deferring the need to construct additional facilities, and for operating cost savings by reducing the frequency of backwashing.

Usually, the Effective Size of the new media is matched to the capacity of the existing backwashing facilities. Sometimes it has been necessary to raise washout troughs to allow for a greater media depth including allowance for bed expansion during backwashing, while in other plants the original trough location has remained satisfactory.

While most of the examples given below are drinking water treatment plants, the techniques are equally applicable to filters used for tertiary treatment of sewage and industrial wastewaters, and several media upgrades have been made to this type of plant.

The technical staff at James Cumming & Sons can advise on filter conversion to achieve improvements in filter performance.

CASE STUDIES

Molendinar Water Treatment Plant:

Operator:
Gold Coast City Council, Queensland

Quantity:
480 m³ C & S Filter Coal

Filter Media:
C & S Coal ES=1.05 mm UC=1.3 max 800 mm deep

Silica Sand ES=0.60 mm 150 mm deep

Height Of Washout:
Troughs above media 500 mm

Process:

The filters at this plant were converted from monomedia sand with an Effective Size of 0.6 mm to dual media with the configuration shown above. Filter run times increased from approximately 8-10 hours to 70-80 hours, and the plant production rate was increased from 140 ML/day to 180 ML/day, the maximum hydraulic capacity of the plant.

Dubbo Water Treatment Plant:

Operator:
Dubbo City Council, NSW

Quantity:
98 m³ C & S Filter Coal

Filter Media:
C&SCoal ES=1.1 mm UC=1.3max 800mmdeep

Height Of Washout:
troughs above media 650 mm

Process:

The original sand media had an Effective Size of 0.56 mm. This was fully replaced by the C & S Filter Coal as above, resulting in mono media filters with a substantially larger Effective Size and lower Uniformity Coefficient. A four fold increase in filter run times was achieved, and the plant's throughput capacity increased by 45% over the original design capacity, allowing capital expenditure to be substantially delayed.

Mardi Water Treatment Plant:

Upgraded using larger effective C & S Brand Filter Coal

Operator:
Wyong Shire Council, NSW

Quantity:
500m³ C & S Filter Coal

Filter Media:
C & S Coal ES=1.65-1.75 mm UC=1.4 max 900 mm deep

Silica Sand ES=0.5-0.6 mm UC=1.4 max 375 mm deep

Support Layer:
Graded Silica Gravel

Height Of Wash Water:
Troughs above media 1000 mm

This direct filtration plant has 8 filters and produces 70 ML/day. It serves the population of Albury, a major regional centre on the NSW / Victorian border.

Obenvale Water Treatment Plant

Operator:
Singleton Council, NSW

Quantity:
205 m³ C & S Filter Coal

Filter Media:

C & S Coal ES=1.6-1.8 mm UC=1.3 max 1350 mm deep

Silica Sand ES=0.7-0.8 mm UC=1.35 max 150 mm deep

Support Layer:

Graded Gravel 450 mm deep

Height Of Washout:

Troughs above media 1200 mm

Process:

The Mardi plant is a 200 ML/day direct filtration plant operating 12 gravity filters. The first 6 filters were commissioned with imported anthracite coal media with a smaller Effective Size. Short filter run times which restricted plant throughput were experienced during the first few years of operation. To overcome this problem, the anthracite coal was replaced by C & S Filter Coal with parameters as listed above, which resulted in a 30% increase in filter run times. The second stage with 6 additional filters was then completed, using C & S Filter Coal with the same specifications.

Lower Molonglo Sewage Treatment Plant:

Lower Molongo Sewage Treatment

upgraded from ES= 1.0 - 1.1mm UC = 1.5 max to C & S Filter Coal

ES = 1.7 mm +/- 0.05mm UC = 1.3 max

Operator:
ACT Electricity & Water, Australian Capital Territory

Quantity:
1200 m3 C & S Filter Coal

Filter Media:
C & S Coal ES=1.65-1.75 mm UC=1.3 max 1200 mm deep

Silica Sand ES=0.65-0.75 mm UC=1.35 max 300 mm deep

Height Of Washout:
troughs above media 800 mm

Process:

The Lower Molonglo Water Quality Control Centre is a modern 100 ML/day sewage treatment plant serving the whole of Canberra, the capital city of Australia. The activated sludge process is followed by chemical addition, coagulation,

flocculation, and tertiary filtration. The imported anthracite coal originally installed was replaced by a coarser C & S Filter Coal, resulting in an increase in maximum throughput rate of 60% and a five fold increase in filter run length, with no loss in effluent quality.

Googong Water Treatment Plant:

Operator:

ACT Electricity & Water, Australian Capital Territory

Quantity:

585 m³ C & S Filter Coal

Filter Media:

C & S Coal ES=1.65-1.75 mm UC=1.35 max 1000 mm deep

Silica Sand ES=0.55-0.65 mm UC=1.35 max 450 mm deep

Support Layer:

Graded Silica Gravel 250 mm deep

Height Of Washout:

troughs above media 1100 mm

Process:

The Googong Water Treatment Plant is a 200 ML/day conventional water treatment plant operated in peak summer

demand periods to serve the population of Canberra. The dual media filters originally had Granular Activated Carbon as the upper media. It was established over the first few years of operation that GAC adsorption was not required as part of the treatment process, but that the grading of the GAC was restricting normal filtration performance. The GAC was replaced by C & S Filter Coal, resulting in a 100% improvement in filter run lengths.

Grahamstown Water Treatment Plant:

Upgraded from mono media filter sand to dual media

Operator:
Hunter Water Corporation, NSW

Quantity:
450 m³ C & S Filter Coal 750 mm deep

Filter Media:
C & S Coal ES=1.4-1.5 mm UC=1.35 max 350 mm deep

Silica Sand ES=0.6-0.7 mm UC=1.5 max 300 mm deep

Support Layer:
Graded Silica Sand 750 mm

Height Of Washout:
troughs above media

Process:

This 300 ML/day conventional treatment plant with flocculation and sedimentation tanks and mono media sand filters was converted to a contact filtration plant with coarse dual media filters in 1988. The cost of converting the filters was recouped in the first year of operation in chemical savings alone. This plant serves part of the city of Newcastle.

Eastbank Water Treatment Amplification:

Operator:
Brisbane City Council, Queensland

Quantity:
400 mJ C & S Filter Coal

Filter Media:
C&SCoal ES=1.15-1.25mm UC=1.3max 300 mm deep

Silica Sand ES=0.55-0.65 mm UC=1.4 max300 mm deep

Support Layer:
Graded Silica Sand 300 mm

Height Of Washout:
troughs above media 1500 mm

Process:

A 700 ML/day conventional treatment plant with sedimentation followed by mono media sand lfilters was upgraded with the addition of a 300 mm deep layer of C & S Filter Coal. The plant treats water for the city of Brisbane and surrounding areas.

North Pine Water Treatment Amplification:

Operator:
Brisbane City Council, Queensland

Quantity:
280 m³ C & S Filbr Coal

Filter Media:
C & S Coal ES=1.1-1.3 mm UC=1.3 max 800 mm deep
Silica Sand ES=0.55-0.65 mm UC=1.3 max 300 mm deep

Support Layer:
Coarse Silica Sand 450 mm deep