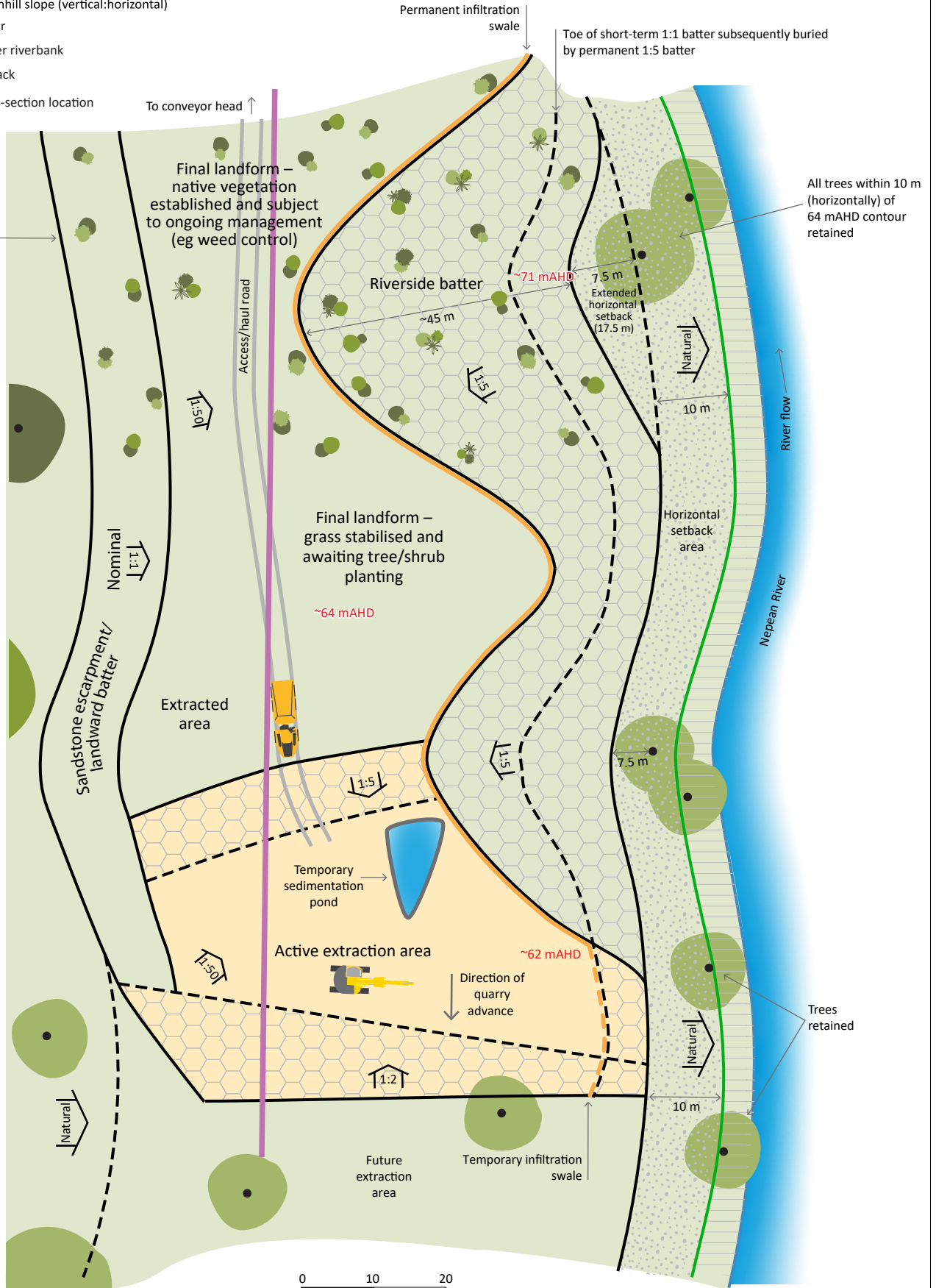


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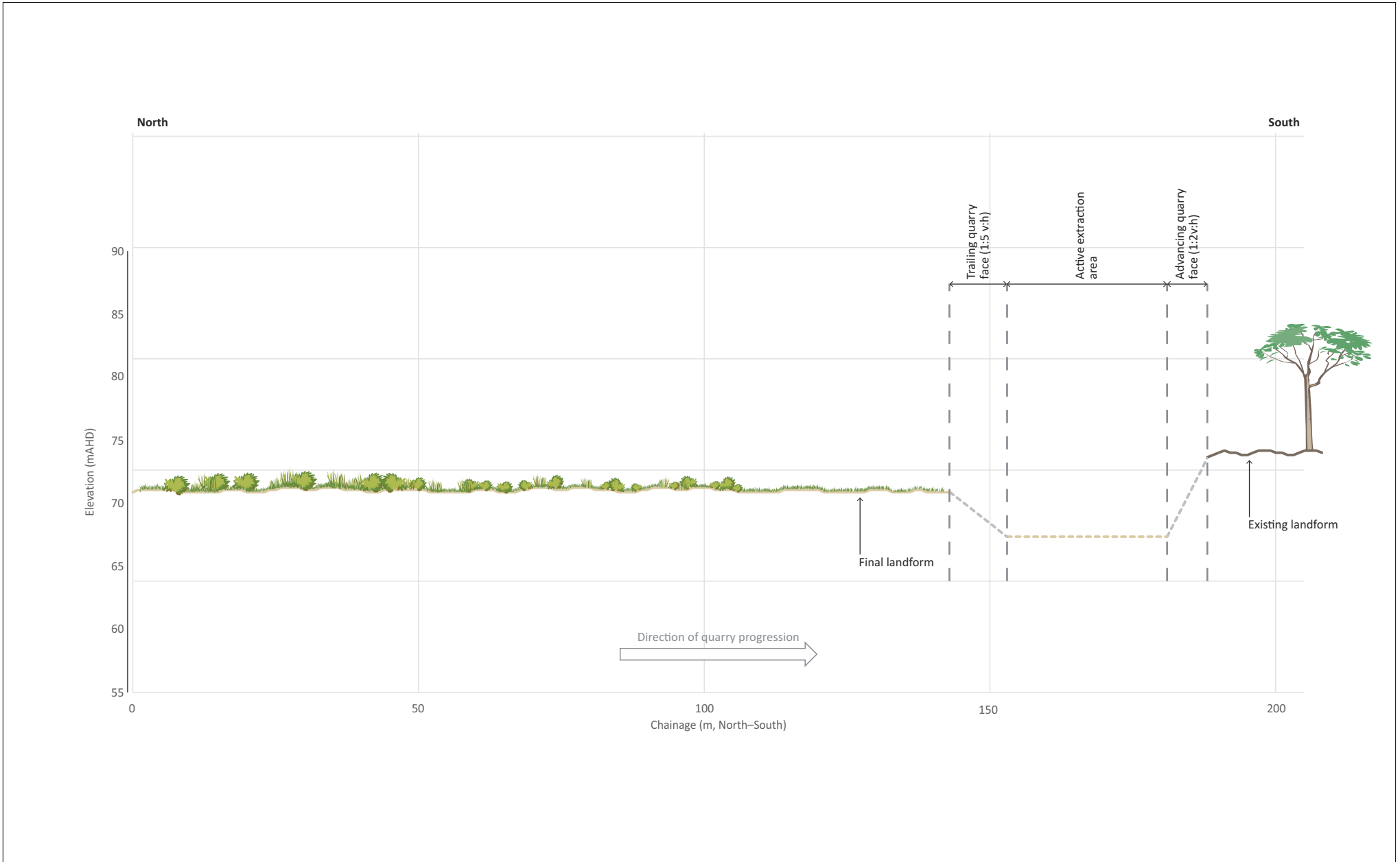
- ~64 mAHD Typical spot height
- 64 mAHD contour
- Downhill slope (vertical:horizontal)
- Batter
- Lower riverbank
- Setback
- Cross-section location



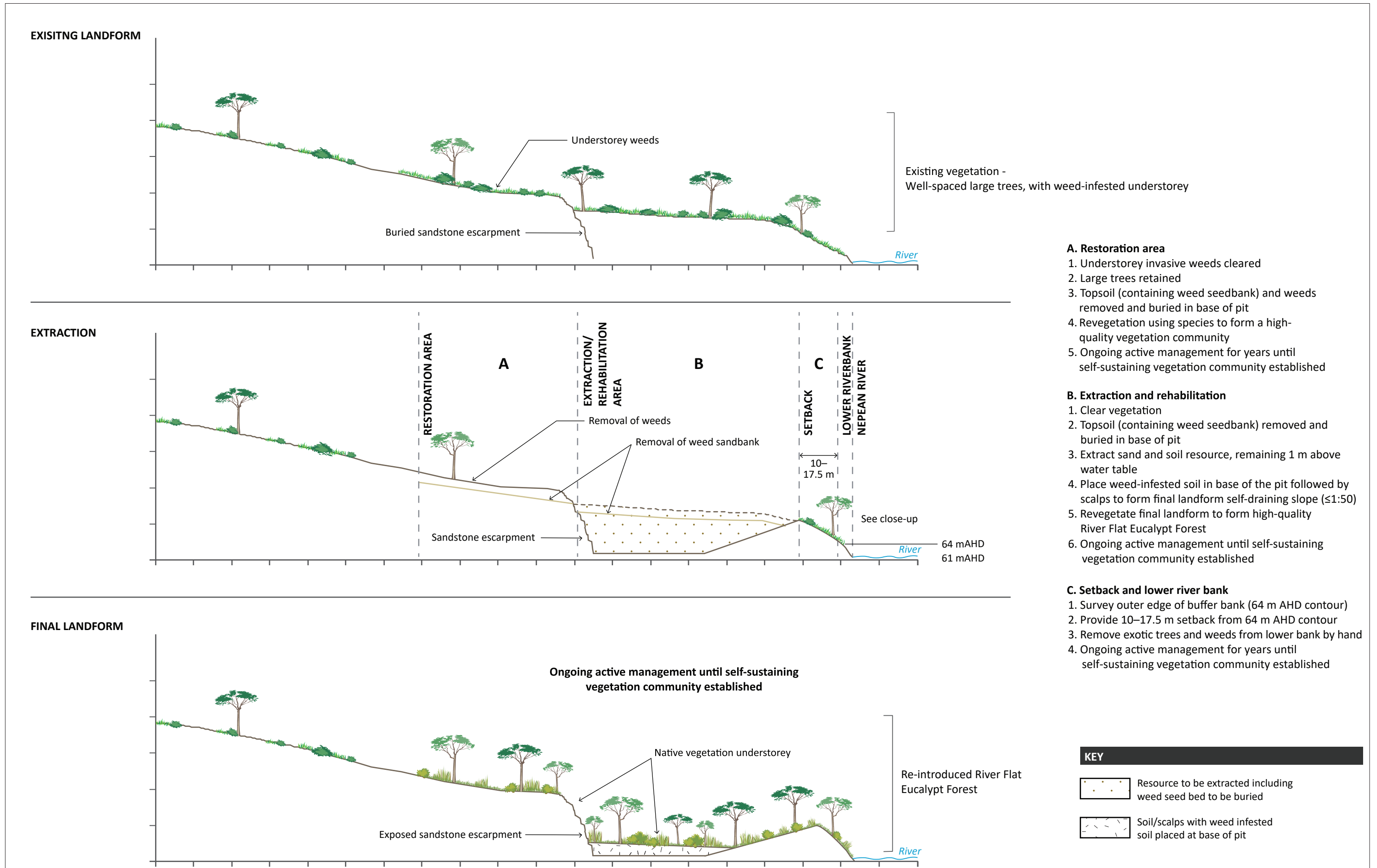
Quarry progression schematic

Menangle Quarry Extension

Figure 2.6



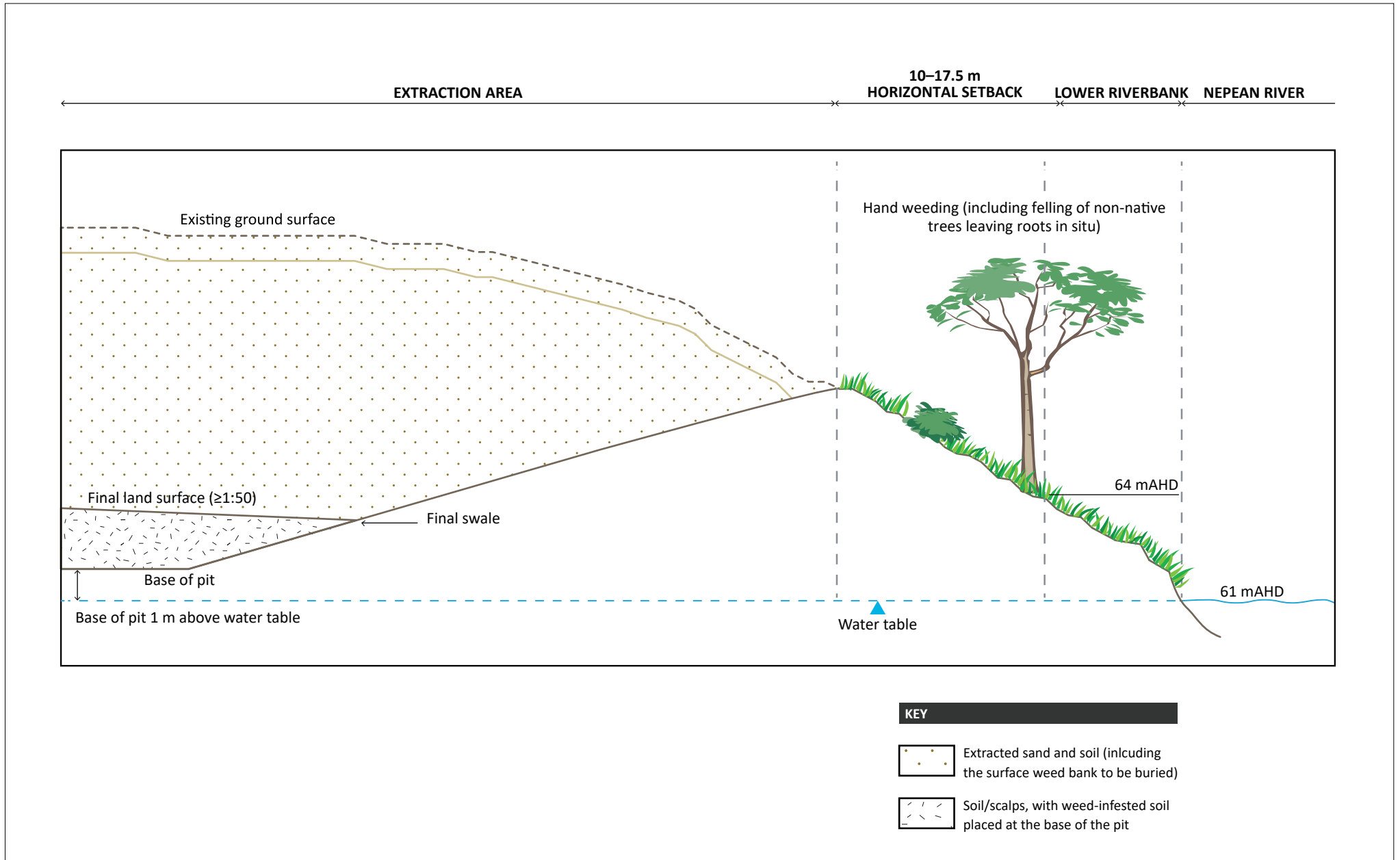
Quarry progression cross-section
 Menangle Quarry Extension
 Figure 2.7



- A. Restoration area**
1. Understorey invasive weeds cleared
 2. Large trees retained
 3. Topsoil (containing weed seedbank) and weeds removed and buried in base of pit
 4. Revegetation using species to form a high-quality vegetation community
 5. Ongoing active management for years until self-sustaining vegetation community established

- B. Extraction and rehabilitation**
1. Clear vegetation
 2. Topsoil (containing weed seedbank) removed and buried in base of pit
 3. Extract sand and soil resource, remaining 1 m above water table
 4. Place weed-infested soil in base of the pit followed by scalps to form final landform self-draining slope ($\leq 1:50$)
 5. Revegetate final landform to form high-quality River Flat Eucalypt Forest
 6. Ongoing active management until self-sustaining vegetation community established

- C. Setback and lower river bank**
1. Survey outer edge of buffer bank (64 m AHD contour)
 2. Provide 10–17.5 m setback from 64 m AHD contour
 3. Remove exotic trees and weeds from lower bank by hand
 4. Ongoing active management for years until self-sustaining vegetation community established



Indicative cross-section – close-up
 Menangle Quarry Extension
 Figure 2.9

ii Riverside batter

The riverside batter will be inland of the horizontal setback area (Figure 2.6).

It is proposed that:

- a temporary riverside batter with a maximum slope of 1:1 m (vertical: horizontal)³, will be used during sand and soil extraction – this will allow the efficient extraction of the resource;
- following extraction of the resource above this batter, the batter will be then built up with suitable site material to give a permanent slope of 1:5 – this will provide additional assurance that the bank will be stable if the active extraction area is flooded during extraction;
- the maximum length of the riverside batter that has a slope between 1:1 and 1:5 will be restricted to 30-m long so that it can be returned to a 1:5 batter within 12 hours if flooding is predicted;
- regardless of the amount of material required, the maximum length of the riverside batter that has a slope between 1:1 and 1:5 will be restricted to 30 m, measured parallel along the river;
- in the final landform, the riverside batter will have a permanent slope of 1:5 – this will provide additional assurance that the bank will be stable in the long term; and
- if over the life of the quarry, activities temporarily cease in the extraction area such that the excavator is relocated from the Stage 8 area, the riverside batter will be always left as a 1:5 batter.

iii Advancing quarry face

The quarry will progressively advance upstream at an average rate of about 150 m/year. The advancing quarry face will face downstream.

During large floods, river water may overtop the lower riverbank and horizontal setback area and flow into the active extraction area or may overtop the riverbank upstream of the active extraction area and flow along the bank to enter the active extraction area over the advancing face. A maximum batter angle of 1:2 will be applied to the advancing face so as to minimise any scour occurring as the water initially flows down the batter, until the water level in the extraction area is at the same level as the river.

iv Trailing quarry face

The trailing quarry face, between the active extraction area and backfilled extracted area, will face upstream.

A maximum landward batter angle of 1:5 is proposed for this face as it will face upstream in a flood. As for the riverside batter, this will mitigate the scour risk.

v Landward batter

The landward, or inland, batter is on the side of the extraction area furthest from the river (Figure 2.6).

A maximum landward batter angle of 1:1 is proposed as it will be exposed to far lower flood current speeds and peak shear stress than the riverside batter. There may be a steeper angle on the landward side of the extraction area where it is formed by the natural sandstone rock escarpment, which in places, may be vertical.

³ All slopes in this report are expressed as vertical:horizontal.

vi Base of the extraction area

Bores will be installed in the base of the active extraction area prior to the commencement of extraction in each successive substage and the water level will be recorded daily during active operations. The resource will be extracted in a manner that ensures that the base of the extraction area is always at least 1 m above alluvial water table resulting from the normal low flow water level in the Nepean River.

2.3.3 Pre-extraction surveys

Prior to any extraction occurring in each substage area, a qualified surveyor will:

- mark the boundary of the extraction area closest to the river as defined by the 64 m AHD contour;
- mark the extent of the 10-m-wide horizontal setback area;
- mark all living native trees with their trunk within the 10-m-wide horizontal setback area;
- place a peg 7.5 m horizontally landward of each tree within the 10-m-wide horizontal setback area – marking the extent to which the existing bank will be retained, ie forming the 10-m to 17.5-m-wide horizontal setback area;
- mark all other boundaries of the extraction area such that the area of each substage does not exceed the area in Table 2.1; and
- mark the boundaries of the adjacent restoration (no resource extraction) area.

2.3.4 Vegetation clearing

Vegetation will be cleared in campaigns ahead of sand and soil extraction. The area cleared at any one time will be minimised but will provide sufficient area to allow safe operations in the extraction area (allowing for the height of standing trees). The maximum extent of the cleared, but un-rehabilitated, extraction area will be 1 ha, but it is expected that a smaller portion will actually be cleared at any one time.

The timber will be stored onsite, prior to being periodically milled onsite using a portable mill. The milled timber will be used for fencing and other construction in the local area. Through a related entity, Menangle Sand and Soil control about 600 hectares in the local area where this milled timber will be used.

2.3.5 Topsoil removal

Topsoil will be stripped to a depth of approximately 0.2–0.3 m. Given that the topsoil in the Stage 8 area contains the seedbank for the noxious weeds infesting the area, this weed-infested material will be placed in the bottom of the preceding extraction area, following resource extraction, and will be covered by material returned as part of creating the final landform (see Section 2.8.1). It is important to bury these weed-infested soils deeply to prevent weed re-emergence.

2.3.6 Resource extraction

The sand and soil resource in the Stage 8 area will be extracted using an excavator and off-road haul truck. It will only be extracted to within 1 m above the water table (see Section 2.3.1). The excavator will load the haul truck, which will then transport the sand and soil to the conveyor head (see Section 2.4.1).

2.3.7 Dredging

Historically dredging has been used to extract sand from the Nepean River and is permitted in the existing Consent. Dredging is not proposed as part of the extension project (Stage 8).

2.4 Onsite material transport and processing

2.4.1 Stage 8 area material transport

Proposed Stage 8 works include the progressive construction of a haul road within the proposed Stage 8 area (see Figures 2.3 to 2.5). This haul road will follow existing cleared tracks.

An off-road haul truck will be used to transport excavated sand and soil from the active extraction area to the start of the conveyor, where it will be tipped.

At the conveyor head, sand and soil will be loaded into a self-powered screen which will remove the oversized material (>4 mm scalps). These scalps will be hauled back to the open excavation for use in rehabilitation. The screen will discharge sand and soil onto a conveyor.

The conveyor will be progressively extended south as the extraction moves south (see Figures 2.3 to 2.5). The conveyor will be a temporary structure (approximately 1.5-m high and 1-m wide) that will be removed upon completion of the project.

2.4.2 Processing

Mobile screens within the processing area are used to remove roots and coarse material (>4 mm) 'scalps'. The mobile stacker attached to the screen discharges screened soil into a stockpile for sale or blending. Some material is further screened to create specific blended soil products using mobile screening plants and a washing plant.

The wastes from the washing plant consist of organics such as pebbles, roots and fines (very fine sand, silt, and clay particles) in water. These wet fines are gravity fed to the settling pond in the processing area and are mostly recovered from the pond and blended into products. The remaining silts are used to rehabilitate the site.

No changes to material processing are proposed.

2.4.3 Blending

Environment Protection Licence (EPL) 3991 lists the type of wastes that can be accepted by the facility and the limits and conditions imposed on the acceptance and stockpiling of this waste. Extracted material is currently blended with these imported materials, where necessary.

No changes to material blending are proposed.

2.4.4 Stockpiling

Very little material is stockpiled in the extraction areas. Stockpiles are mainly kept in the processing area.

No changes to material stockpiling are proposed.

2.5 Access

2.5.1 Site access

The main access to the site is from Menangle Road. Menangle Road is an arterial road which provides sub-regional access. It is not proposed to change the site access for inbound materials or outbound materials.

2.5.2 Access to the Stage 8 area

Light vehicles accessing to the Stage 8 area will use the existing access under the Hume Motorway. The existing access was retained when the RMS bisected the lands when acquiring the corridor for the original Hume Highway in 1969. The existing access road under the bridge will be sealed and will comply with RMS drainage and pavements standards.

The earthmoving equipment, off-road haul truck and other plant to service the Stage 8 area will access the area via Moreton Park Road. Major plant is expected to remain onsite through-out the duration of the quarrying operations except for major servicing or replacement.

2.5.3 Product dispatch

No changes to product dispatch are proposed. Truck movements at the site (ie combined inbound and outbound movements) will not exceed an average of:

- 147 per day on Monday to Friday; and
- 80 per day on Saturday.

2.6 Quarry life

The proposed modification to the existing consent for the quarry would extend the approved life of the quarry for 15 years, from 2020 to 2035.

2.7 Biodiversity protection

A land 'swap' is proposed, surrendering the approval to extract sand and soil from the Stage 3 area (5.68 ha) for the same area (in hectares) of the Stage 8 extraction area on a 1:1 basis.

In addition, it is proposed to restore areas upstream, downstream and upslope of the extraction areas. These restoration areas are shown in Figures 2.3 to 2.5 and will form biodiversity offsets to compensate for the clearing of vegetation in the Stage 8 area that is not part of the land swap. Management of the restoration areas will include the removal of the extensive exotic vegetation in the restoration area, allowing restoration of the entire bank, back to a sustainable, high-quality, native ecosystem.

A Stage 8 area vegetation management plan will be prepared that:

- provides details of the conceptual final landform, soil stripping and vegetation clearing protocols, erosion and sediment control measures, rehabilitation of the extraction area and adjacent restoration activities;
- describes how the implementation of the biodiversity offset strategy will be integrated with the overall rehabilitation of the site; and
- details how connectivity will be managed during the rehabilitation program.

A full-time rehabilitation specialist will be employed as part of the Stage 8 area operations.

2.8 Rehabilitation and closure

2.8.1 Progressive rehabilitation of the Stage 8 area

Following completion of resource extraction, any weed-infested topsoil will be placed in the base of the extracted area followed by scalps and fines. These will be used to build up the base of the extracted area to about 64 mAHD. Following construction of the final landform, the area will be immediately planted with grasses to stabilise the surface. Native vegetation will then be established through planting and seeding. There will be ongoing active management of the rehabilitated extraction area, including weed control.

2.8.2 Final landform

The extraction area design (see Section 2.3.2), as amended to incorporate changes made since the Refusal, will result in the following final landform:

- the lower riverbank (below 64 mAHD) landform will be unchanged;
- the landform in the 10-m to 17.5-m wide horizontal setback will be unchanged;
- the land will slope down at 1:5 from the landward edge of the horizontal setback to 64 mAHD (the riverside batter);
- the infiltration swale along the toe of the riverside batter will be retained to prevent runoff from the final landform flowing overland to the river;
- a nearly-level area at about 64 mAHD gently sloping (1:50) down to the infiltration swale at the toe of the riverside batter;
- a 1:1 slope, or the exposed sandstone escarpment, down to the western edge of the extracted area; and
- the landform in the restoration area and outside of the extraction area will be unchanged.

The rate and volume of extraction will be monitored to ensure that a final landform can meet these design parameters.

Conceptual final landforms are provided in Figures 2.10 to 2.13.

As described in Section 2.3.2i, the horizontal setback area will vary between 10-m and 17.5-m wide along the length of the extraction areas, depending on the exact locations of trees within the 10-m wide horizontal setback. Conceptual final landforms are presented for a 10-m wide horizontal setback and a 17.5-m wide horizontal setback. The actual final landform will be a mixture between these two conceptual final landforms.

The accuracy of the existing contours is limited by the digital elevation model accuracy. It is not currently possible to improve this accuracy through a detailed topographic survey of the entire Stage 8 area given the density of woody weeds in much of the area. These weeds need to be cleared prior to a detailed survey which would compromise the stability of the land surface if undertaken in a single campaign across the entire Stage 8 extraction area. A qualified surveyor will survey each substage area prior to any extraction occurring in the substage and a detailed final landform for the substage will be prepared.

The base of the ephemeral creek in the southern part of the extraction area will be left at its present elevation below 64 mAHD.

The inland batter of the extraction area will be a 1:1 (vertical:horizontal) sand and soil slope or the currently buried sandstone escarpment. The exact location and slope of the buried sandstone escarpment will vary along the extraction areas. A nominal, 1:1 (vertical:horizontal) has been assumed in the conceptual final landform. Some of this area may be low exposed sandstone cliffs as currently occur upslope of the extraction area.

Over the coming decades, ongoing sand and soil deposition from the river's floods will fill the low areas, eventually recreating the current terraced benches.

2.9 Site infrastructure and services

2.9.1 Site buildings

There is a compound containing the administrative offices and allied buildings immediately at the site entrance on Menangle Road. The compound comprises:

- an existing site office and amenities building, housing offices, kitchen amenities and soil laboratory;
- an existing wheel wash and weighbridge are located at the top of an elevated bank, level with the floor level of the main building;
- an existing large workshop housing equipment and machinery as well as a storage area for ancillary machinery; and
- existing fuel supply tanks.

No changes to site buildings and infrastructure are proposed.

2.9.2 Lighting

There will be no changes to lighting in the processing and site entry areas.

No fixed lighting will be required in the Stage 8 area as extraction will only occur in daylight hours.

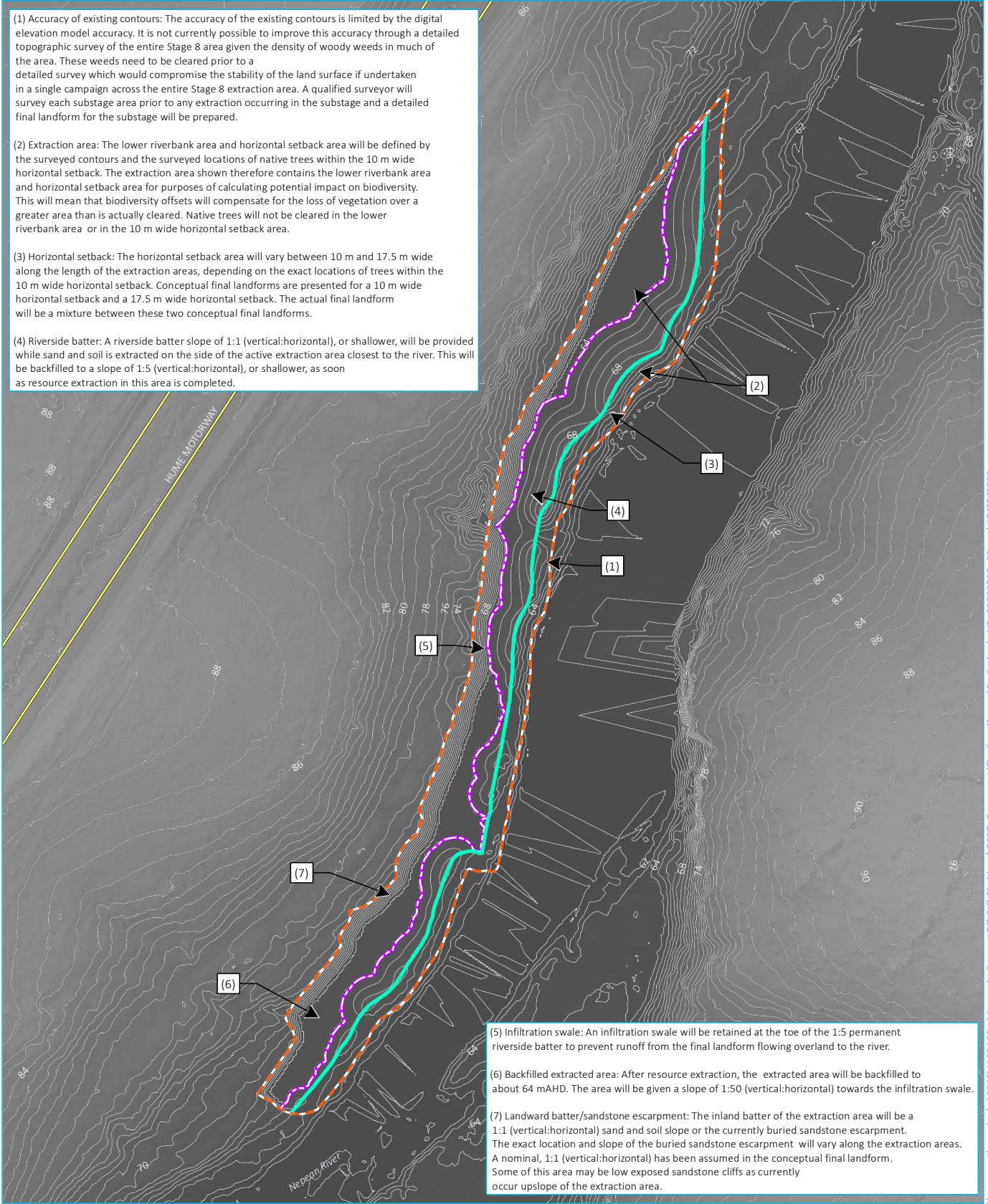
2.10 Hours of operation

The existing development consent allows the quarry to operate over the following hours:

- 6 am to 5 pm Monday to Friday;
- 6 am to 12 pm Saturday; and
- with no operations on Sundays or public holidays.

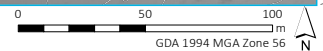
No changes to the approved hours of operation are proposed.

- (1) Accuracy of existing contours: The accuracy of the existing contours is limited by the digital elevation model accuracy. It is not currently possible to improve this accuracy through a detailed topographic survey of the entire Stage 8 area given the density of woody weeds in much of the area. These weeds need to be cleared prior to a detailed survey which would compromise the stability of the land surface if undertaken in a single campaign across the entire Stage 8 extraction area. A qualified surveyor will survey each substage area prior to any extraction occurring in the substage and a detailed final landform for the substage will be prepared.
- (2) Extraction area: The lower riverbank area and horizontal setback area will be defined by the surveyed contours and the surveyed locations of native trees within the 10 m wide horizontal setback. The extraction area shown therefore contains the lower riverbank area and horizontal setback area for purposes of calculating potential impact on biodiversity. This will mean that biodiversity offsets will compensate for the loss of vegetation over a greater area than is actually cleared. Native trees will not be cleared in the lower riverbank area or in the 10 m wide horizontal setback area.
- (3) Horizontal setback: The horizontal setback area will vary between 10 m and 17.5 m wide along the length of the extraction areas, depending on the exact locations of trees within the 10 m wide horizontal setback. Conceptual final landforms are presented for a 10 m wide horizontal setback and a 17.5 m wide horizontal setback. The actual final landform will be a mixture between these two conceptual final landforms.
- (4) Riverside batter: A riverside batter slope of 1:1 (vertical:horizontal), or shallower, will be provided while sand and soil is extracted on the side of the active extraction area closest to the river. This will be backfilled to a slope of 1:5 (vertical:horizontal), or shallower, as soon as resource extraction in this area is completed.



- (5) Infiltration swale: An infiltration swale will be retained at the toe of the 1:5 permanent riverside batter to prevent runoff from the final landform flowing overland to the river.
- (6) Backfilled extracted area: After resource extraction, the extracted area will be backfilled to about 64 mAHD. The area will be given a slope of 1:50 (vertical:horizontal) towards the infiltration swale.
- (7) Landward batter/sandstone escarpment: The inland batter of the extraction area will be a 1:1 (vertical:horizontal) sand and soil slope or the currently buried sandstone escarpment. The exact location and slope of the buried sandstone escarpment will vary along the extraction areas. A nominal, 1:1 (vertical:horizontal) has been assumed in the conceptual final landform. Some of this area may be low exposed sandstone cliffs as currently occur upslope of the extraction area.

Source: EMM (2020); DFSI (2017); ELVIS (2020)



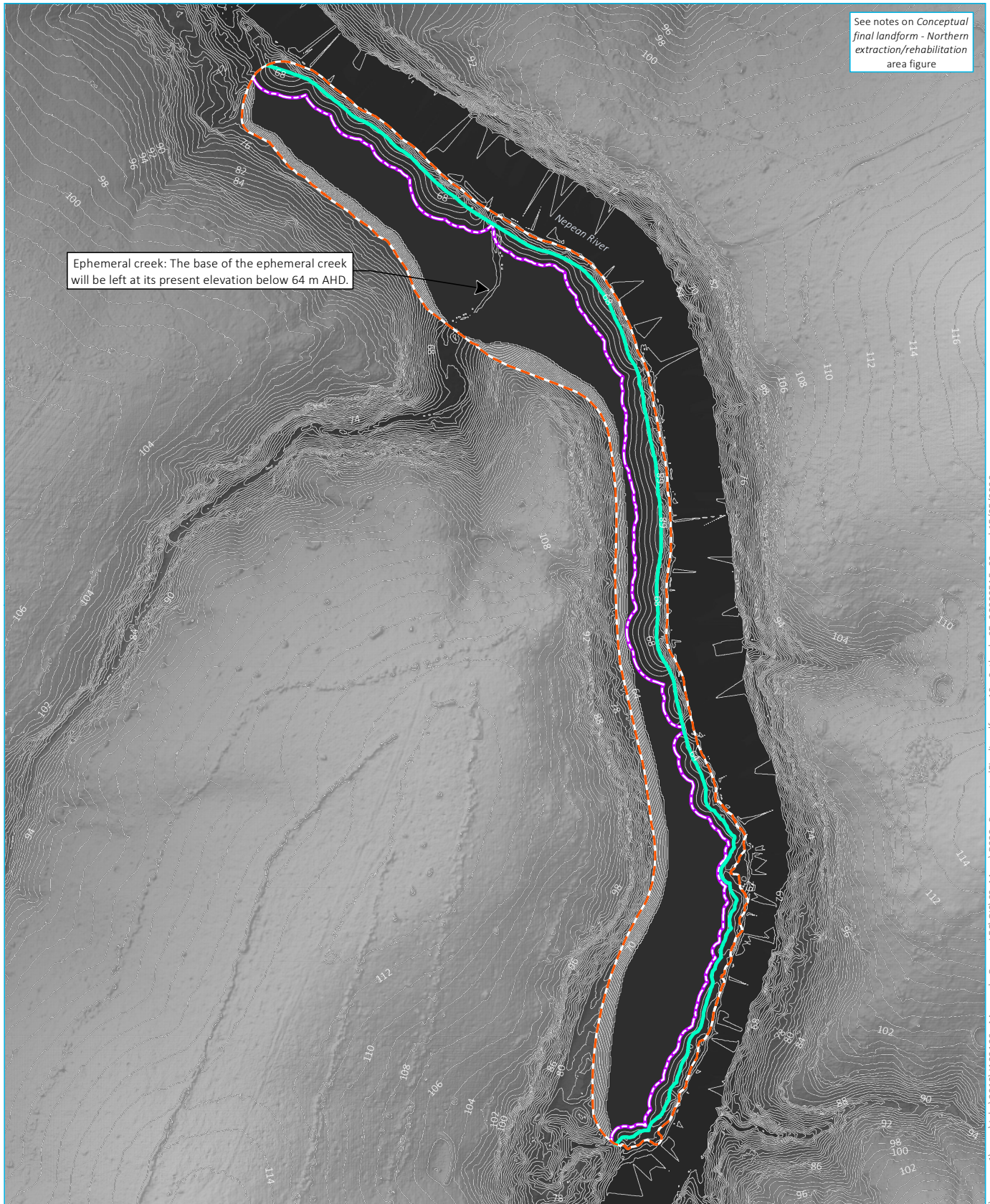
KEY

- Stage 8 - extraction/rehabilitation area
- Inland extent of horizontal setback (10 m)
- Infiltration swale/toe of riverside 1:5 permanent batter
- Contour (1 m)
- Major road

Conceptual final landform 10 m setback
Northern extraction/rehabilitation area

Menangle Quarry Extension
Figure 2.10

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See notes on Conceptual final landform - Northern extraction/rehabilitation area figure

Ephemeral creek: The base of the ephemeral creek will be left at its present elevation below 64 m AHD.

Source: EMM (2020); DFSI (2017); ELVIS (2020)

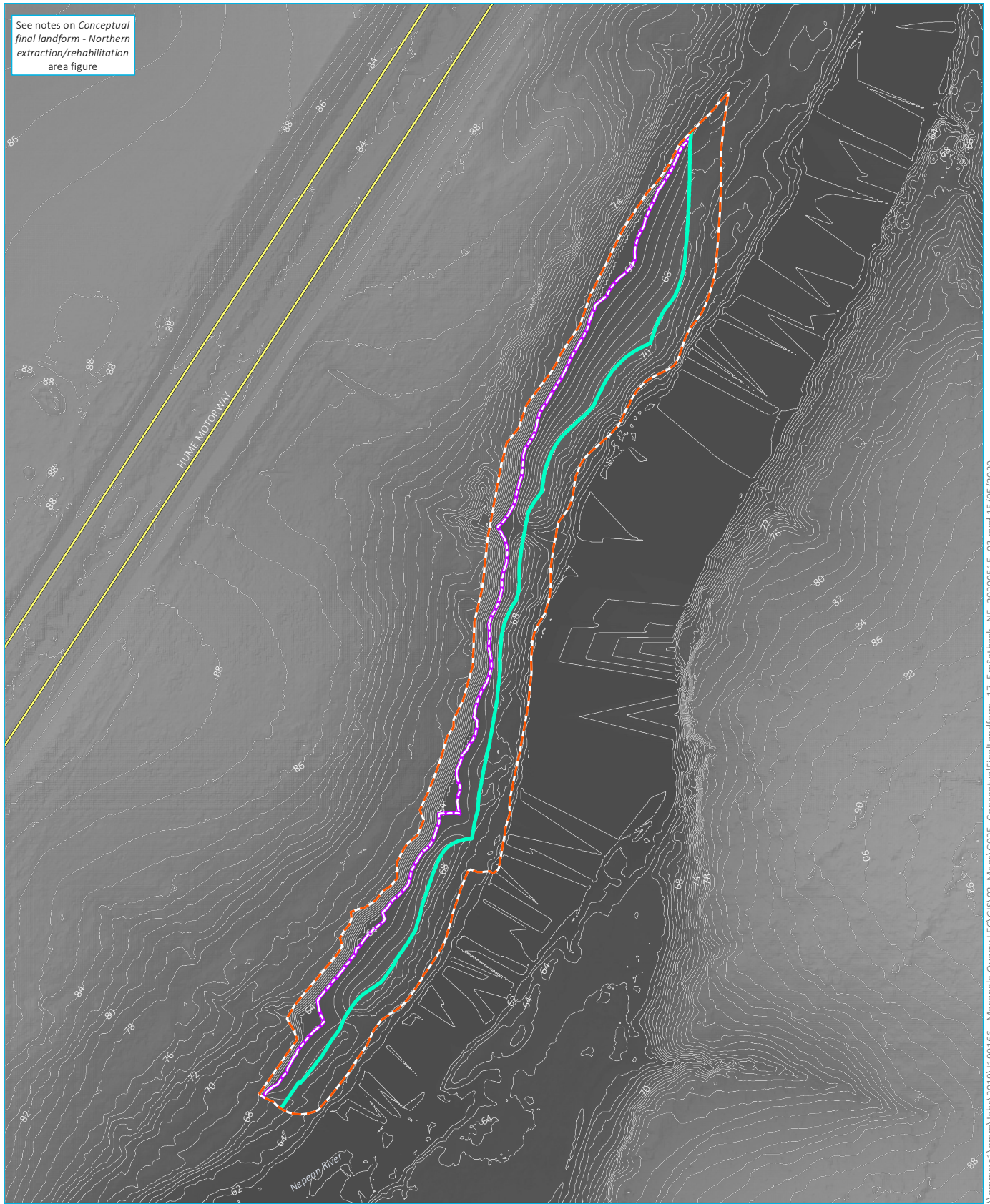
KEY

-  Stage 8 - extraction/rehabilitation area
-  Inland extent of horizontal setback (10 m)
-  Infiltration swale/toe of riverside 1:5 permanent batter
-  Contour (1 m)

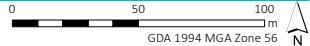
Conceptual final landform 10 m setback
Southern extraction/rehabilitation area

Menangle Quarry Extension
Figure 2.11






See notes on Conceptual final landform - Northern extraction/rehabilitation area figure



Source: EMM (2020); DFSI (2017); ELVIS (2020)



KEY

-  Stage 8 - extraction/rehabilitation area
-  Inland extent of horizontal setback (17.5 m)
-  Infiltration swale/toe of riverside 1:5 permanent batter
-  Contour (1 m)
-  Major road

Conceptual final landform 17.5 m setback
Northern extraction/rehabilitation area

Menangle Quarry Extension
Figure 2.12



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