

6. MITIGATION AND MONITORING

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6.1 Introduction

This chapter contains a summary of the actions proposed by Holcim to mitigate the adverse effects of the proposed cement plant and associated quarries/pits and to monitor certain parameters associated with the implementation of the project.

Those mitigation actions that form part of the proposal are also described in Section 3, Description of this Proposal. The mitigation actions described in this section (Section 6) also form part of the overall proposal for the project. Monitoring would be undertaken for a range of areas within the project.

Further discussion of mitigation and monitoring is found in the technical reports, which form appendices to this Assessment of Effects on the Environment.

6.1.1 Conditions of consent

Holcim anticipates that there would be a range of conditions attached to the resource consents required for the project.

Specific resource consent conditions are expected to be applied in respect of some matters. In other instances however, the complexity of, and need for flexibility with, some of the proposed mitigation actions makes it more appropriate for such matters to be considered in the context of a management plan.

Matters that would be covered by specific conditions include:

- Noise limits on operations at all sites.
- Air emission levels at the cement plant site.
- Water discharge quality controls.
- Heritage and Archaeological discovery protocols.

6.1.2 Management plans

As part of the control of effects for each of the sites, Holcim is proposing to prepare a series of Management Plans. Specifically, it is proposed that, as a general condition of the consents sought, Holcim would be required to prepare a series of Management

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Plans. This would provide for the development and ongoing refinement of a wide range of management actions. The management plans proposed include:

- Construction Management Plans.
- A Traffic Management Plan that covers all traffic associated with the project.
- Noise Management Plans for each site, including management of construction noise.
- Stormwater Management Plans for each site.
- Dust Management Plans for each of the quarry/pit sites.
- A Stock and Weed Control Plan for the Escarpment area.
- An Annual Work and Rehabilitation Plan for quarries and pits.

The preparation, review and compliance with Management Plans would be required by resource consent conditions. The purpose of Management Plans is to deal with issues that would change over time and may differ according to different seasons or progress over the life of the project.

The general content of these Management Plans would be set out through conditions of consent, requiring consideration of an appropriate level of control. However the Management Plan approach allows for adaptive management in response to different conditions and results of ongoing monitoring. The Management Plans would be updated regularly and would be flexible to respond to different circumstances.

The activities that could be carried out as part of this programme of management plans fall into a number of categories:

- Implementation details for actions imposed as conditions of consent which would act as mitigation for the Holcim consents.
- Actions which Holcim needs to ensure are carried out as mitigation, but which for practical reasons cannot be interpreted as specific conditions on a consent, e.g., details of the dust management at the quarry/pit sites, and its ongoing review and adaptation.
- Processes to enable response to the results and analysis of monitoring (adaptive management), or to changes in the local environment that are not related to the implementation of the Holcim consents.

These actions are all considered to be of high priority, and are drawn together into Management Plans in accordance with the overall conditions of consent. Under the Management Plans, the details of the location, quantity, degree or design of management actions would be addressed. It is anticipated that preparation of the final Management Plans and their implementation would be an ongoing process, extending beyond the resource consent application process.

The content of each of the proposed Management Plans would reflect:

- The recommendations of the Technical Reports prepared as part of the Assessment of Environmental Effects process.
- The consent conditions.
- Inputs from Holcim operational staff.
- Inputs from public consultation as part of the consenting process.

Holcim will continue to progress draft Management Plans prior to the hearing and would seek to undertake this with input from the Councils and stakeholder groups.

Although the final Management Plans would be prepared subsequent to the granting of resource consent, conditions would be imposed on the consents requiring their preparation prior to commissioning of any of the project sites, requiring a process for their regular review and updating, and setting out what each Plan would include. It is

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proposed that they would address the following general areas, as they relate to these consents:

- (a) **Objectives for management** – the outcomes sought for the specific Management Plan.
- (b) **Indicators** to be used to determine, through monitoring, whether or not the objectives for management are being achieved.
- (c) **Implementation methods** to achieve the objectives for management.
- (d) A specific programme for carrying out the methods in the short to medium term, including **timeframes and interaction** with other Management Plans as appropriate.
- (e) A **monitoring programme**, including methods for feeding the results of monitoring into the adaptive management cycle and, if warranted, the adaption of specific implementation methods and the review of the Management Plans where required.

6.2 Mitigation of effects through the project design itself

For more details on the project design and processes, refer to Section 3 of this Assessment of Environmental Effects.

A range of mitigation measures are built into the project itself. These include:

- Control of hours of operation, including:
 - Hours in which operation would occur at the quarries and pits.
 - Timing of delivery of raw materials to the plant site.
- Selection of particular access points to all sites.
- Controlling quantities of materials moved to and from sites, including:
 - Scale of truck movements per day, to and from each site.
 - Scale of train movements each day.
- Design of the plant site layout, including building and structure location in relation to visibility.
- Landscaping of the plant site including bunding.
- Dust management during construction, covering of raw materials where possible and dust filters on equipment where applicable.
- Incorporating various forms of noise screening around the plant site and exposed parts of the quarries/pits, such as earth mounding (bunding).
- Setting noise generating activity and equipment back from site boundaries.
- Locating buildings and stockpiles on the plant site in positions where they would provide localised screening of noisy activities, wherever possible.
- Enclosing equipment in buildings and orientating buildings away from noise sensitive activities.
- For equipment with moving parts that vibrate such as fans or compressors, isolating the moving part by, for example, placing these on a rubber pads or springs.
- Installing silencers on fans and other attenuating systems.
- Providing for storage, treatment and management of onsite wastewater and stormwater.
- Providing safe storage and use of hazardous substances.
- Use of the tunnel and conveyor from the main quarry to the plant site to minimise visibility and truck movements.
- Use of the rail system to minimise truck movements.

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- No blasting would occur in the quarries/pits.
- Designing quarries and pits so as to minimise noise and visual impacts.
- Design of water management systems to maximise reuse wherever possible.
- Use of a water treatment plant at Ngapara to appropriately treat water for coal fines.
- Planting of wetland and riparian areas.
- Stock fencing around wetlands and areas of indigenous vegetation.

6.3 Air

For more details refer to the Air Report in Appendix 14.

A range of measures for the control of air emissions and mitigation of their effects are included in the project description. These include:

- Covering or containment of raw materials stores, coal stores, clinker and cement stores and the conveyor.
- Bag filters with modern baghouse technology to control dust emissions from the main and cement mill stacks, together with a number of smaller fugitive dust sources.
- SO₂ reductions would be achieved by absorption in the kiln. The plant design includes a kiln preheater, precalciner system and closed raw mill that together act as an effective sulphur scrubber (to clean exhaust gases).
- NO_x emissions are to be minimised by the latest kiln technology, incorporating a modern pre-calciner and selective non-catalytic reduction (SNCR).

The quarrying of raw materials and associated stockpiling activities at the proposed cement manufacturing plant have the potential to generate dust. Therefore, it is necessary to consider the mitigation measures that could be used to control dust emissions.

In relation to quarrying and stockpiling operations, it is proposed that a Dust Management Plan be prepared for each site. In each case, this Plan would include the measures to be used to control dust including:

- Removal and stockpiling of excavated material within 300m of a sensitive area¹, when the wind is blowing towards the sensitive area will only take place if wind speeds are below 18 kph.
- Construction vehicles operating within 300m of sensitive areas will travel at less than 20 kph, unless the construction area or haul road is fitted with operational sprinklers.
- Removal of excavated material within 300m of a sensitive area during wind speeds above 36 kph will only occur if the wind is blowing away from the sensitive area.
- Material that is placed in temporary stockpiles that will not be disturbed for more than three months will be planted with vegetation as soon as possible.
- All areas of exposed soil will be planted with grasses/pasture or other appropriate vegetation as soon as practical.

The haul roads are located within the quarry areas and dust from these would also need to be managed under the Dust Management Plans. Methods for this management would include speed control for trucks and road watering. It is proposed that where haul roads are less than 300m from a sensitive area, a limit of 20kph be

¹ A sensitive area is defined as a residence, school, hospital or community facility. In addition an activity such as horticulture that can be impacted upon by dust may also be considered a sensitive activity in this context.

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used. The two most common methods of applying water are water carts and fixed sprinklers.

The other measure that can be used to control dust emissions from unsealed roads is regular road maintenance. As vehicles move over the road, they breakdown the surface material, which leads both to the potential for dust generation, and also increased road resistance on the vehicles. Therefore, it is proposed that the haul roads would be maintained as and when necessary and practical to provide the optimum operational conditions. This would involve measures such as grading, and the laying of fresh gravel.

Control measures that would be used to assist in the mitigation of effects include having an effective complaints procedure that ensures that all concerns are dealt with as quickly as possible and actioned accordingly.

As part of the internal requirements of all Holcim Group cement companies there are a range of compounds that are either continuously, or periodically, monitored in the cement plant discharges. These are set out in Table 6.1.

Continuously monitored	<ul style="list-style-type: none"> • Nitrogen oxides • Sulphur dioxide • Carbon monoxide • VOC's • Particulates
Monitored on an annual basis	<ul style="list-style-type: none"> • Significant Metals • Dioxins • Hydrogen Chloride • Ammonia • Benzene

Table 6.1: Compounds that are either continuously, or periodically, monitored in the cement plant discharges

Holcim would undertake monitoring for these compounds at its proposed plant at Weston, and is proposing that the data from this monitoring be provided to the Otago Regional Council on an annual basis.

Due to the concerns that exist over some pollutants in the environment, Holcim proposes to carry out the following additional ambient monitoring:

Particulate (PM₁₀)	It is proposed that a continuous PM ₁₀ monitor (that meets the requirements of AS 3580.9.6) be installed, probably a beta gauge monitor. The most appropriate location for a monitor is in Weston, possibly the school, as this is the largest population centre close to the site and this monitor would be operated for at least 5 years, after which the need to continue monitoring would be reviewed.
	In addition, it is also proposed that a PM ₁₀ monitor be located adjacent to the plant site in the location in which maximum off-site concentrations have been predicted so that the approach used to calculate baghouse emissions can be confirmed.
Sulphur Dioxide (SO₂)	It is proposed that a continuous sulphur dioxide monitor be installed for a minimum period of one year to verify the modelling results. It would be preferable to have the monitor located relatively close to the plant, as all of the predicted high concentrations are quite localised. However another option is to have the monitor close to the site for six months and then move it to a location in Weston, for a further six months. In the event that the monitoring indicated that off-site concentrations were higher than those predicted, the monitoring period would be extended.
	It is also proposed that some long term (passive) sulphur dioxide monitors be located near to the escarpment, to confirm the predictions for sulphur dioxide in this area. These monitors would be used for a period of 1 year.

Table 6.2: Proposed additional ambient monitoring

There is the potential for deposition particulate to be generated by the various quarrying activities. Because of the remoteness of the Windsor site, the air quality consultants URS do not consider that there is significant potential for effects associated with the sand pit and, therefore, monitoring is not proposed for that location. However, URS consider that monitoring should occur at the coal pit at Ngapara, at least until the engineered landforms (ELF) have been totally rehabilitated. URS recommend that there should be at least two monitors, one in the predominant up wind direction and the other in the predominant downwind direction. URS also consider that there is merit in undertaking monitoring adjacent to the tuff quarry, and again recommend that there are at least two monitors located around that site. Holcim proposes to implement monitoring in accordance with these recommendations. Potential locations for monitors are shown in Appendix 14.

6.4 Traffic/Transport

For more details refer to the Transport Report in Appendix 7.

One key aspect of mitigation of effects on the transport system is the use of the branch railway for the transport of cement to the Port. This would greatly reduce the number of potential vehicles on the roading network compared to movement of cement by truck.

Mitigation of potential traffic/transportation effects incorporated within the proposal includes control of the routes to be taken by both construction and operational traffic. Preferred routes have been identified that would minimise effects on the transportation network including avoiding peak times on certain routes. Use of these routes by staff and contractors (including movement of raw materials) would be dealt with through a Traffic Management Plan which would set out the routes to be used for different trips undertaken in conjunction with other measures e.g. lower speeds through built up areas. A Construction Traffic Management Plan may be required

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separately from an operational Traffic Management Plan to control the different effects occurring during the construction phase.

In particular, control in the Management Plan would be given to ensuring that there is control over the routes used by trucks moving raw materials as proposed in the project description (see Section 3). It is important to note that effects of transportation of raw materials are further mitigated through the plant being located adjacent to the source of limestone, and close to other raw materials, thus minimising road transportation requirements.

Where possible Holcim would seek through the Management Plan to mitigate impacts of staff travel, and this is likely to include the provision of a company bus for staff travel from Oamaru to the plant site. This would reduce the number of staff vehicles at the peak times when the shift changes are occurring and thus reduce pressure on key roads and intersections. Holcim also employs strict driver recruitment practices and on-going professional driver performance review processes.

The Traffic Management Plan would incorporate a process of review of transport routes used during both the construction and operation phases and would provide for changes in preferred routes over time according to changes in the roading system.

Site-specific mitigation of impacts on the roading network would also be provided through the location and formation of appropriate and safe site accesses at each site, including appropriate sight distances and potentially acceleration and deceleration lanes if necessary. The use of what is the preferred route via Peaks Road rather than Victoria Hill Road to access the Windsor sand pit is seen as a form of mitigation of effects on Windsor Village as it would ensure that trucks do not travel through the village.

6.4.1 Overweight/over dimension loads

At the time of construction, the components of the plant buildings and structures are likely to include overweight and over dimension loads which would need to be transported to the plant site from the Port of Timaru. Once the dimensions and weights of these loads are known, suitable transport routes would be determined in consultation with the Waitaki District Council and Transit New Zealand. Ensuring routes are available may involve temporarily restricting on-street parking at key locations, lifting overhead cables or temporarily removing street furniture. Timing these deliveries to avoid times of highest demand on the roading network would reduce the potentially disruptive effects of this activity.

6.4.2 Branch Railway

Mitigation of effects of the reinstatement of the branch rail line to the plant site would be addressed under the Outline Plan of Works process which is separate from these resource consent applications. However, mitigation of potential safety concerns at the intersections of the rail line with roads has been investigated by Holcim and it is proposed to ensure that adequate measures (such as bells, lights or barriers, signage, road markings and pedestrian crossing locations) are installed as required, subject to further advice and input from OnTrack.

6.5 Noise

For more details refer to the Noise Report in Appendix 6.

A range of measures to control noise and mitigate against adverse effects of noise have been incorporated into the project. These include:

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- Controls over normal operation hours at the quarries/pits as described in the project description (see Section 3).
- Noise screening around all areas of the plant site containing significant noise sources as described in the project description and the Noise Report.
- Orientation of buildings on site to provide additional localised screening of individual sources of noise.
- Equipment or groups of equipment which are often external in other cement plants would be enclosed in buildings.
- Moving equipment would incorporate vibration isolation measures.
- Fans would be fitted with attenuators.
- Quarry trucks at the tuff quarry would stay at least 450m from the nearest house.
- Equipment selection and attenuation of equipment noise for machinery operating in the sand pit, if necessary to meet noise limits.
- Northbound trucks from the site and trucks to the site from the north are to be encouraged to use Seven Mile Road/Airedale Road, especially during peak times.

It is anticipated that conditions would be placed on the resource consents to control noise. It is proposed that included in these conditions would be the requirement to produce a Construction Noise Management Plan (based around the long-term noise limits from New Zealand Standard NZS 6803:1999) and a Noise Management Plan for each site.

The Noise Management Plan for the plant site would set out how performance standards in the consent are to be actioned. This would be based on a Noise Budget as described within the Noise Report (Appendix 6).

For the purposes of consent conditions, a control is proposed which is stricter than the maximum noise levels allowable by the District Plan, but allows scope for detailed design and tolerance. It is therefore proposed that an acceptable envelope be determined and the cement plant detailed noise control design would be conducted to ensure the final noise contours do not extend beyond this envelope. It is proposed that this envelope be defined by four noise control points: one to each side of the cement plant site as shown in the Noise Report (Appendix 6). It is proposed that there be a condition of consent which requires that noise emissions from the cement plant, at the four noise control points, be less than:

- 55dBA L_{10} 7:00am – 10:00pm Monday – Friday.
- 55dBA L_{10} 7:00am – 7:00pm Saturday.
- 40dBA L_{10} at all other times.

It is proposed that there be a condition of consent which requires that noise emissions from each of the quarry and pit sites, at the notional boundary of all occupied residential units (other than those owned or acquired by Holcim) existing at the time the application is lodged and continue to exist in the future, are less than:

- 55dBA L_{10} 7:00am – 10:00pm Monday – Friday.
- 55dBA L_{10} 7:00am – 7:00pm Saturday.
- 40dBA L_{10} at all other times.

It has been noted in the Noise Report that at the coal pit southern ELF there would be a period of time when the daytime noise limits proposed above would be exceeded at the nearest residential unit. An appropriate proviso should be added to this proposed consent condition to allow for this while equipment is operating in this specific area (with agreement of the residential unit owner).

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Noise monitoring would be conducted to verify that each of the sites complies with the noise limits described above. This noise monitoring would be carried out in accordance with NZS 6801, and would include:

- (a) Commissioning noise measurements at the four noise control points around the cement plant site. This would be conducted at the start of the cement plant operation.
- (b) Between 9 and 12 months operation, noise verification measurements would be conducted at the same positions as in (a) and also at the nearest two residential units to each of the quarry/pit sites.

If Waitaki District Council receive legitimate noise complaints or have reason to suspect an increase in noise levels, further noise monitoring could be conducted as requested by the Council. Unless there were to emerge a situation of apparent concern or complaint, Holcim does not consider that regular (e.g. annual) or permanent noise monitoring would be necessary.

6.6 Landscape

For more details refer to the Landscape Report in Appendix 8.

6.6.1 Landscape Mitigation

As far as possible, the Holcim proposal has been designed with a view to minimising adverse landscape and visual effects. However, the proposal includes a series of landscape measures intended to mitigate residual adverse landscape and visual effects. These would occur at both the plant and quarry/pit facilities. They would occur at the outset of construction of the plant and throughout the lives of the quarry/pits. The progressive rehabilitation of the pits would contribute to temporary and long-term mitigation for landscape and visual impacts associated with quarrying and pit activities.

The Landscape Master Plan for the plant site and Concept Rehabilitation Master Plans contained within Appendix 8 show the long-term rehabilitation proposals for the sites, including planting proposed.

The planting proposed for various aspects of the plant and quarry sites is presented in provisional plant lists (see Appendix 8). In all cases, planting has been designed to reflect existing vegetation occurring within the vicinity of all sites – both native and exotic species.

6.6.2 Weston Plant Site

The existing landforms provide screening from the northeast for even the tallest vertical structures of the manufacturing plant. However, it is impossible to screen them from both immediate and long distance views to the west and southwest, although there is potential to provide screening to the lower components of plant operations. As such, the Master Plan for the plant site incorporates a combination of earth bunding and screen planting both along the site boundaries and within the interior of the site. The extensive planting proposed within the site would also contribute to providing a landscaped 'setting' to the plant facility. This would ameliorate impacts upon wider landscape amenity values. Stormwater retention ponds in the northern part of the site would contribute a positive landscape feature alongside extended amenity planting of deciduous exotic trees in this vicinity. The earth bunding proposed along the Weston-Ngapara roadside has also been designed to assist with mitigating potential noise effects associated with the operations of the plant.

A mix of amenity and screen planting would be planted into mitigation bunding and at strategic locations around the plant site, as shown on the Proposed Landscape Master Plan drawing. This has been designed to fit in with the surrounding landscape and to provide maximum screening of individual structures. A combination of deciduous

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exotics and evergreen conifer trees would provide the bulk of screening, supplemented with primarily native shrubs (based on existing plants found within the local landscape). Topsoils would be stripped, carefully stored in stockpiles and re-used as part of mitigation and amenity planting around the plant site.

Landscape mitigation would be established during the two year construction phase of the plant site.

6.6.3 Weston Limestone Quarry

The visibility of the limestone quarry when viewed from limited locations to the east would be substantially reduced by the treatment of the upper face of the quarry back wall, which would remain exposed throughout the majority of operations. It is proposed to treat the upper back wall of the quarry immediately following extraction of this face, by planting and seeding.

Whilst limestone excavations at Weston would permanently modify the landform, there is potential to mitigate the change in land use and land cover in the long-term through appropriate rehabilitation of the quarry. The Concept Rehabilitation Master Plan for the limestone quarry site illustrates the rehabilitation proposals for the site. The staging of operations at Weston (in relation to the extraction of siltstone) would restrict somewhat the progressive rehabilitation of the main quarry being implemented during ongoing quarrying operations. However, this part of the quarry is not visible from public viewpoints.

It is proposed that the rehabilitation of a small section of the northeast end of the existing escarpment (which is to be removed in the early years of quarry development) is undertaken at the earliest opportunity to minimise adverse visual and landscape effects. This would require careful contouring of overburden material (sourced from the main quarry) in order to successfully marry in with the existing escarpment profile.

6.6.4 Weston Tuff Quarry

Views into the tuff quarry from both local and long-range locations are already partly screened by existing vegetation to the northwest of the site. It is proposed to extend the screening benefits of this vegetation by planting along both the northeast and western boundaries of the quarry with similar fast growing species. Planting along the northeast boundary of the quarry, between the haul road and the Waiareka Creek tributary, would be supplemented by a selection of native and exotic plantings into earth bunds. Riparian planting would also provide a positive enhancement to the existing stream. Screen planting along the western boundary of the tuff quarry, parallel with Coal Pit Road, would be in keeping with the appearance of existing agricultural shelter belts in the area.

6.6.5 Ngapara Pit

The mining of lignite coal at Ngapara would involve substantial landform modifications within the extent of quarrying operations. The final landforms, following extraction operations, have been designed to marry in with the existing terrain in order to minimise permanent landscape and visual effects. This would be achieved through progressive rehabilitation where feasible during extraction operations. Mitigation would be provided through the stabilisation and seeding of the final pit faces and ELF during ongoing extraction operations.

Given the existing landscape context, Holcim considers it more appropriate to provide mitigation to potential views into the pit through appropriate rehabilitation of landforms and cut faces, rather than through screen planting. Again this approach enables mitigation proposals to be incorporated into the long-term rehabilitation of the site.

6.6.6 Windsor Pit

The nature of extraction operations at Windsor mean that the working face would be difficult to screen from the adjacent farmsteads. However, in the longer term, the pit would be rehabilitated into productive agricultural use as illustrated in the Concept Rehabilitation Master Plan. The Windsor sand pit would be rehabilitated progressively.

6.6.7 Landscape Rehabilitation Proposals

It is proposed that all quarries and pits are rehabilitated back into productive land use following extraction operations, appropriate to their existing agricultural contexts and land use. The rehabilitation of quarry/pit sites also plays a significant role in minimising residual landscape and visual effects associated with 'temporary' quarrying operations.

The process of extraction operations for all quarries and pits, where feasible, would enable these to be rehabilitated progressively through the backfilling of extracted overburden. Prior to reaching this 'steady state' of operations, extracted overburden would be utilised, to varying degrees, in the construction of mitigation screening bunds/ embankments and water management structures. Surplus quantities of overburden would be stockpiled. The 'pre-stripping' of topsoil from Weston sites, including the manufacturing plant footprint, prior to extraction operations, would be managed carefully to ensure the viability of productive soils at Weston for use in mitigation and proposed amenity plantings, along with future rehabilitation of the land back into pasture.

The phasing of quarrying operations varies for each site, particularly in relation to the volumes of overburden expected to be produced and the point at which the steady state of extraction is reached. As such the progressive rehabilitation of individual quarries and pits are site specific. The concepts proposed for the final rehabilitation of each quarry/pit site are illustrated in the Concept Rehabilitation Master Plan drawings (see Appendix 8).

Weston

Early rehabilitation would be limited to rehabilitation of initial siltstone excavations from the end 'nose' of the escarpment crest in year 8 through careful backfilling and re-contouring, and re-vegetation of access roads and embankment benches along the back (west) wall of the main quarry, with appropriate native shrub planting.

Once steady state quarrying has been reached (around year 20), newly extracted overburden would be backfilled into the main quarry.

With the cessation of limestone quarrying from the main quarry at Weston, stockpiled overburden would be returned to the quarry and contoured to marry in with the newly created landform. The steep back wall of the quarry would retain its native mitigation planting, whilst the reformed ground within the remainder of the pit would be conditioned and graded in preparation for continuing productive agricultural use. The water treatment pond, which is to be constructed within Troublesome Gully, would be retained as a permanent feature leading into a small wetland area. The treatment pond to the west of Coal Pit Road is temporary and would eventually be filled in.

The quarrying of weathered tuff at Weston, to the north of the escarpment, would enable the progressive backfilling of extracted overburden, after 13 years of ongoing quarrying operations. Prior to this steady state being reached, overburden would be stockpiled on site. Small quantities of initial overburden and topsoil stripped from this site would be utilised in the formation of mitigation bunds along the northern boundary of the tuff quarry. The bunds would be subsequently planted with screen vegetation. Progressive rehabilitation would follow the course of quarrying operations westwards, across the site. After approximately 30 years, stockpiled overburden would be returned to the pit and graded to fit in with the newly created landform. The ground would subsequently be conditioned and graded in preparation for continuing productive agricultural use.

Rehabilitation of the tuff quarry site would also involve the removal of the workshop buildings. The main haul road linking the tuff quarry with the limestone pit via Troublesome Gully would be narrowed from an operational width of 28m and retained as a farm access track.

Ngapara

During the approximately 15 years of coal extraction operations at Ngapara, around a total volume of 11 million bank cubic meters of overburden is expected to be extracted from the open cast pit. The initial stripping of the pit footprint would generate overburden, which would be progressively formed into the two permanent ELF to the east of the pit. These ELF have been modelled on the existing terrain, the final shaping of which would be determined on site, but with the intention that they be appropriate for future farming operations.

Overburden would also be utilised in the formation of haul roads, lay-down areas and water management structures. By year 8, fresh overburden would be backfilled into the pit as part of progressive rehabilitation.

With the cessation of extraction operations, the final coal pit would be re-graded to a maximum slope angle of 18° to enable grazing to be resumed. The final form of the pit would be consistent with the surrounding landscape and would be largely refined on site.

The workshop buildings would be removed, whilst the farm access tracks would be retained. The water treatment ponds, located to the southeast of the quarry pit beside Bobbing Creek Road, would be retained along with the proposed accompanying wetlands area.

Windsor

The proposed sand pit at Windsor would be progressively rehabilitated following several years of start-up operations. During this time, initial overburden would be utilised, where necessary, to embank the existing railway alignment from the site as a preferred haul route for transporting sand between Windsor and Weston. Surplus overburden would be stockpiled. The embankment would utilise topsoil stripped from the site and be seeded with grass.

After 7 years of establishment operations, the hillside pit would be progressively rehabilitated, through backfilling with overburden and topsoil, alongside the ongoing extraction of sand in a westward direction. Following the projected 30 years of extraction operations at Windsor, the pit would be graded to marry the final contours into the existing hillside terrain in order to be returned to productive pasture. The haul road along the existing railway alignment would be retained as a farm track.

Table 6.3: Proposed rehabilitation concepts

6.7 Geological/Quarrying/Slope Stability

For more details refer to the Mine Planning and Slope Stability Reports in Appendices 16 and 17.

A range of mitigation measures have been built into the quarry planning which has shaped the detailed location and dimensions of the quarries and pits. This includes:

- Reduction in disruption to the escarpment at Weston, where possible, by maintaining a 'buffer' between the outside edge of the quarry and the main escarpment. The width of buffer along the escarpment would vary based on geotechnical requirements (including stability) which would be determined once quarrying commences, but is estimated to be around 25m.
- The disturbed footprint area has been reduced where possible; both for the ultimate and interim stages, incorporating in-pit backfilling where practical.
- Archaeological sites have been avoided whenever possible.
- Quarrying would be undertaken using ripping by dozers/excavators and movement by conventional truck and loader methods. This would avoid blasting at all sites.
- Final quarry floors would be free draining, if practical, to reduce pumping requirements and avoid formation of end quarry lakes.
- Batters and benches would be sloped to ensure stability both short term during operation and long term after rehabilitation.

Appropriate slope angles have been determined for temporary quarry faces, overburden stockpiles, engineered landforms and final quarry slopes. These angles have been designed to ensure stability under all conditions and would be refined at each site according to site-specific conditions.

Ongoing monitoring would occur as a natural part of the operation of each of the quarry/pit sites. This would include the operation of the sites, ongoing management of stability and drainage, and protection of staff safety.

6.8 Hazardous Substances

A range of substances, classified as Hazardous Substances, would be stored and used in the proposed operations, including significant volumes of used oil at the plant site.

In all cases and with all substances, Holcim would ensure that the necessary primary and secondary containment systems are employed. This would involve a range of measures appropriate to the specific substances, designed to ensure that there is no risk of hazardous substances gaining uncontrolled entry to the surrounding environment. There would also be relevant segregation of chemical storage, and specialist training would be given to all employees using chemicals.

All primary and secondary containment systems would be custom designed and built to capture and control the substances, as they are at other Holcim sites. This design and control would be coordinated with the control mechanisms under other legislation e.g. the Hazardous Substances and New Organisms Act (HSNO).

Appropriate certification would be required for all handlers of hazardous substances under the HSNO regulations. Holcim would use a software package called ChemAlert to list all chemicals used at each site, their quantities, and storage locations. Material safety data sheets would be available for all chemicals at their dispensing points and also in a central location.

Spill kits, fire extinguishers, and other safety equipment would be suitably located around hazardous substance areas with appropriate signage. There would also be a trained emergency response team in case of accidents and fires.

6.9 Water Management

For more details refer to the Water Report in Appendix 15.

The key mitigation measures in relation to water management are built into the overall proposal through the use of appropriate systems on each site to:

- Capture, treat re-use, and/or dispose of stormwater and pit/quarry water, including the diversion and disposal of clean water.
- Capture and treat wastewater prior to reuse or disposal.
- Obtain water from on-site storage ponds, and from a bore or from the North Otago Irrigation Company.

At Ngapara one particular aspect of mitigation is to avoid acid rock drainage (ARD). The details of this mitigation and monitoring are set out in the Water Report and include monitoring of materials during mining, use of the water treatment plant, application of limestone if necessary, site-specific design of engineered landforms, and ongoing monitoring. At Weston and Windsor no specific mitigation is likely to be required from a geochemical perspective.

The water treatment plant at Ngapara would be designed to mitigate against any adverse effects relating to water quality discharges. The plant would be able to remove coal fines and would include pH adjustment as necessary. Discharge would be measured in relation to total suspended solids with a concentration goal of less than 30g/m³. During commissioning of the water treatment plant, levels would temporarily be higher (up to 100g/m³).

A range of monitoring would be undertaken at each site. This monitoring would include:

Weston Plant Site	<p>Monitoring of water quality and soil chemistry within the soil absorption basins for pH and dissolved metals. This would also include monitoring of adjacent groundwater.</p>
Weston Quarries	<p>A routine monitoring program would be developed for the site to assess any effects resulting from operations. Initial discharge sampling would include a comprehensive suite of metals and chemical parameters to determine parameters suitable for routine analysis.</p> <p>It is proposed that the routine water quality monitoring on a monthly basis would take place at the following locations:</p> <ul style="list-style-type: none"> • Discharge from limestone/siltstone treatment pond; • Discharge from the tuff pit treatment pond; • Waiareka Creek upstream of convergence with the unnamed tributary; and • Waiareka Creek downstream of convergence with the unnamed tributary. <p>It is proposed that the following water quality parameters would be determined for when water is actually being discharged as there is likely to be dry periods:</p> <ul style="list-style-type: none"> • pH; • Suspended solids; and • Dissolved metals.
Ngapara	<p>Geochemical monitoring both within the pit and from the engineered landforms. This would occur during quarrying and post quarrying.</p> <p>Water quality from the sediment pond/water treatment plant (WTP) would be monitored. Initial discharge sampling would include a comprehensive suite of metals and chemical parameters to determine parameters suitable for routine analysis. The routine water quality monitoring on a monthly would take place at the following locations:</p> <ul style="list-style-type: none"> • Discharge from WTP treatment pond; • Waiareka Creek upstream of convergence with Bobbing Creek; and • Waiareka Creek downstream of convergence with Bobbing Creek. <p>It is proposed that the following water quality parameters would be determined:</p> <ul style="list-style-type: none"> • pH; • Suspended solids; and • Dissolved metals. <p>In addition it is likely that the WTP would monitor turbidity and pH continuously on the discharge.</p>
Windsor	<p>A routine monitoring program would be developed for the site to assess any effects resulting from operations.</p> <p>It is proposed that the following water quality parameters would be determined, accepting that there would likely be long periods of nil discharge:</p> <ul style="list-style-type: none"> • PH; • Suspended solids; and • Dissolved metals.

Table 6.4: Proposed water management monitoring

6.10 Terrestrial Ecology

For more details refer to the Ecology Report in Appendix 9.

While there are not considered to be any direct terrestrial ecological adverse effects from the project, it is proposed that some enhancement be provided in the form of protection of indigenous vegetation. It is proposed that the area of more intact escarpment vegetation adjacent to the Weston plant site be protected through fencing this area off from stock grazing and by some active control of weeds. This would provide some overall improvement in the biodiversity of the area and could provide a local seed source for rehabilitation works associated with the project. A simple Management Plan would be prepared for the management of stock and weeds.

Vegetation monitoring, in association with passive SO₂ monitoring, is recommended of vegetation closest to the source (eg: exotic species on neighbouring land on the opposite side of Weston Ngapara Road or north of the site (if possible), on trees near the existing lime works and on native vegetation on the adjacent escarpment). The passive SO₂ monitoring will allow correlation between any visible damage on vegetation with actual SO₂ levels. The purpose of this monitoring is to identify any effects of sulphur dioxide on this vegetation. While no adverse effects are anticipated, this monitoring would be used to inform any necessary mitigation should adverse effects be found in the future.

While the loss of some small wetland areas adjacent to the Ngapara pit would not cause any significant adverse ecological effect, it is proposed that the removed native vegetation be replaced as part of the stormwater treatment at the site. This would replace the lost biodiversity values at this site.

There is no terrestrial ecological mitigation recommended or proposed at Windsor.

6.11 Aquatic Ecology

For more details refer to the Ecology Report in Appendix 9.

Adverse effects related to discharges of storm and waste water are predicted to have a low probability of occurring (low risk). However, to protect aquatic ecosystems from further degradation, and to enhance aquatic ecological values where practical, it is proposed that surface water treatment systems be put in place at each Holcim site. This would include, as appropriate, treating water, sediment control, and planting of vegetation.

It is proposed that there be monitoring of water following discharge from each of the project sites. There would be four monitoring points (see Ecology Report for more details):

- at the Bobbing Creek gully-Bobbing Creek confluence,
- at the Waiareka Creek main road bridge (near Coal Pit Road),
- 20m downstream of the proposed Plant discharge location, and
- at the Windsor Road-Windsor stream crossing.

At each of these points a water and sediment sample would be obtained twice annually immediately following a heavy rain event. Tests would target:

- dissolved oxygen,
- turbidity,
- pH,
- sulphur products,
- faecal coliforms (at the Weston plant site),

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- Metals including iron, zinc, and aluminium.

The waste water at the plant site would be treated through a Membrane Bioreactor, which provides the highest possible quality treated wastewater with the treated wastewater to be re-used predominately for toilet flushing and process water in the cement plant. This would ensure efficient resource use and provide a high quality water product. Any excess treated wastewater would be discharge via subsurface irrigation to vegetation surrounding the plant site. Since the discharge will be subsurface no discharge to the Waiareka Creek will occur and would have no adverse effects.

6.12 Social/Community

For more details refer to the Social Impact Assessment in Appendix 10.

During construction and operations phases a range of methods of mitigation and monitoring are proposed:

6.12.1 Workforce Recruitment, Accommodation, and Management

To minimise disruption to local communities, the local labour market, and the existing social structure, and to avoid major short-run increases in the demand for social services and housing in the Oamaru area, it is proposed that in its workforce planning Holcim and its contractors attempt to minimise the number of project workers and their families that need to move to the area and take up residence.

With a view to maximising local employment on the construction and operation of the project, Holcim would consult with appropriate training organisations and other potential project developers, about establishing a range of basic and skills-related training courses for North Otago workers and job-seekers.

Where long distance commuting is used for the construction, Holcim and its contractors would seek to accommodate its long distance commuting workers in local motels, hotels, rental houses, and in private boarding; and avoid establishing a construction workers' camp.

Having regard to employment opportunities for persons accompanying workers, and the level and range of existing social services, facilities and infrastructure within the North Otago region, it is proposed that Oamaru be the preferred location for the housing of accompanied incoming construction and operations workers.

To avoid a situation where incoming project construction workers become the cause of social disruption in the Oamaru community, Holcim would require its construction contractors to:

- undertake suitable vetting of their employees,
- establish a clear behavioural code for employees, and include behavioural clauses in employment contracts for outside construction workers staying in the Oamaru area,
- devise work schedules that enable sufficient breaks for long distance commuting workers to return home on their days off, and
- regularly liaise with the Oamaru police throughout the construction period over off-work construction workforce behaviour.

6.12.2 Environmental impacts management

To avoid a situation where traffic safety and noise issues unexpectedly arise for Weston School during the project construction, Holcim would regularly liaise with the school principal and Board of Trustees.

As part of its transport planning, Holcim will consult with the Waitaki District Council, Transit NZ, and potentially affected households about speed limits in key locations and instituting a 'no engine braking' regime on all the approaches to Weston.

6.12.3 Accident and Emergency Management

It is proposed that Holcim's construction contractors establish an appropriately equipped and staffed clinic at or near the main site at Weston to attend to workers' on-the-job injuries and illnesses, and to act as a first response in cases of more serious injury or illness.

In its planning for fire and emergency management for the cement manufacturing operation and associated quarries and pits, Holcim will seek to involve the appropriate bodies at the early stages to enable the local services to develop site Management Plans.

6.12.4 Social Impacts Management & Community Liaison

For the construction and operations start-up phases of the project, Holcim propose establishing a Planning and Construction Social Impact Committee with representatives of social and other service providers and local communities, including a position of a coordinator/community worker. The Social Impact Report appended (Appendix 10) provides additional details on this proposal. It is proposed that following the construction and early operations phases of the project, Holcim establish an ongoing Community Liaison Committee which would replace the Planning and Construction Social Impact Committee.

A social impact monitoring programme would be established by Holcim as part of a broader programme of project monitoring. The purpose of the monitoring would be to identify emerging social changes and potential issues over the course of the construction and operations start-up. This monitoring would be aligned with other project monitoring and encompass local knowledge, a complaints recording system, and a response system involving the Planning and Construction Social Impact Committee. The parameters and resourcing of this monitoring would be developed in association with the Planning and Construction Social Impact Committee.

In order to reduce uncertainty and fear about the potential impacts of the project during the planning and approvals phase, Holcim will continue to provide detailed information to local residents and communities on the history of the proposed development, the potential impacts of the proposed Weston Option project, and the company's detailed proposals to avoid, mitigate and manage these impacts.

For the period of the construction and early operations of the project, Holcim would appoint an in-house company environmental liaison officer or team.

6.12.5 Balancing the distribution of project benefits and costs

Holcim proposes to establish a local community trust for the purpose of generating funds for promoting community-based social and environmental development and improvement in the neighbourhoods of the plant, quarries, pits, at Weston, and in the Waiareka Valley. See the Social Impact Report for additional details on this proposal.

To maximise the local benefits of the project, Holcim would adopt:

- a policy of sourcing goods and services from local suppliers where possible and consider complementing this policy with initial investment in the training of potential suppliers so that they can meet the company's required performance standards; and
- a policy of giving preference to the recruitment and training of local people for the new jobs that are being created on the project operations.

6.12.6 Residents' site-related suggestions

In its planning for the proposed development, Holcim will continue to give consideration to the suggestions made by local community members regarding various aspects of the project.

6.13 Cultural/Archaeology/Heritage/Palaeontology

For more details refer to the Historic, Cultural and Archaeological Reports in Appendices 11, 12 and 13.

For Kai Tahu the area has particular values (see Section 4) and a range of the mitigation actions incorporated into the project or proposed on the basis of technical assessment, would act to protect these values. This includes:

- control of stormwater and pit water to protect the Waiareka Creek and its tributaries;
- careful control of hazardous substances to protect the Waiareka Creek and its tributaries;
- monitoring of effects of air emissions on vegetation; and
- extensive rehabilitation of land after quarrying.

Where possible, all known historic or archaeological sites (including rock art) would be avoided. In relation to historic and archaeological finds every practical effort would be made to avoid damage to any historic or archaeological site encountered during construction or operation at each of the sites. An accidental discovery protocol would be in place for all initial earthworks and soil stripping at all sites and staff would be trained appropriately to understand historic and archaeological issues. Archaeological Authorities would be obtained from the New Zealand Historic Places Trust for all site works.

Due to the proximity of known rock art in Troublesome Gully, monitoring is proposed. This would include:

- measurement of relative humidity, wind speed and temperature in the vicinity of the sites, both prior to and during construction, and during the ongoing operation of the quarry and plant; and
- photographic recording of the rock art within the sites, both prior to and during construction, and during the ongoing operation of the quarry and plant.

Comprehensive recording and investigation of the rock art sites would also occur, including:

- photographic recording of all the rock art;
- detailed mapping of each site; and
- archaeological excavation, removal and/or analysis if any feature is deemed to be at risk.

Ongoing discussions are continuing with Te Runanga o Moeraki in relation to options for mitigation.

Holcim (through construction and quarry engineering staff) would record and advise of the discovery of any significant fossils, in accordance with relevant protocols to be detailed in the Annual Work and Rehabilitation Management Plan to be prepared for the Weston quarries. The objective is to ensure, where possible, the identification of any significant fossils unearthed during excavation.