WAIMAKARIRI
DISTRICT COUNCIL

Community and Recreation Committee

Agenda

Tuesday 16 August 2022

3:30pm

Council Chamber
215 High Street
Rangiora

Members:

Councillor Niki Mealings (Chairperson)
Councillor Al Blackie
Councillor Robbie Brine
Councillor Wendy Doody
Councillor Philip Redmond
Mayor Dan Gordon (ex officio)

The Chairman and Members
COMMUNITY AND RECREATION COMMITTEE

A MEETING OF THE COMMUNITY AND RECREATION COMMITTEE WILL BE HELD IN THE COUNCIL CHAMBER, 215 HIGH STREET, RANGIORA ON TUESDAY 16 AUGUST 2022 AT 3:30PM.

Recommendations in reports are not to be construed as Council policy until adopted by the Council

BUSINESS

Page No

1 APOLOGIES

2 CONFLICTS OF INTEREST

Conflicts of interest (if any) to be reported for minuting.

3 CONFIRMATION OF MINUTES

3.1 **Minutes of the meeting of the Community and Recreation Committee held on 19 July 2022.**

6-13

RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Confirms** the circulated Minutes of the meeting of the Community and Recreation Committee, held on 19 July 2022, as a true and accurate record.

4 MATTERS ARISING

5 DEPUTATIONS

6 REPORTS

6.1 **West Eyreton Rifle Club – Feasibility Report – Andy Coker (Community Facilities Team Leader)**

14-227

RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Receives** Report No. 220622106548.

(b) **Approves** the relocation of West Eyreton Rifle Club to Pearson Park Pavilion from Cust Community Centre.

(c) **Approves** that staff proceed to draft and execute an agreement between the Council and West Eyreton Rifle Club for the occupation of the Pearson Park Rifle Range.

(d) **Approves** that staff utilise the remaining balance of $8,823.74 from the allocated budget for a feasibility study ($20,000.00) as seed money to facilitate the upgrades required to bring the building up to compliance standards.

(e) **Approves** that staff allocate a further $6,176.26 from the General Renewals Budget to repair/replace the existing lighting within the range that is due for renewal and supplement the balance of monies from the feasibility study, as detailed in recommendation (c).

(f) **Notes** staff will continue to work with West Eyreton Rifle Club to ensure the transition works with both the Club and existing users of Pearson Park Pavilion.

(g) **Circulates** this report to the Oxford-Ohoka Community Board for information.

6.2 **Community Development Strategy Review – Tessa Sturley (Community Team Manager)**

228-250

RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Receives** report No. 220804133305.

(b) **Notes** that a broad engagement plan will be developed to inform this project.

(c) **Notes** that staff have approached Mahaanui Kurataiao Ltd (MKT) to identify the most appropriate way forward in ensuring a bicultural, partnership approach is applied to the development of the strategy.

(d) **Supports** a review of the Waimakariri Community Development Strategy, as an overarching framework for all work that ensures ongoing delivery of people-centered Council Community Outcomes.

6.3 **Youth Development Update – Emily Belton (Youth Development Facilitator)**

251-273

RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Receives** Report No. 220804133781.

(b) **Notes** that staff will present the Community and Recreation Committee with an overview of plans around a more youth-friendly District.

6.4 **Library update to 4 August 2022 – Paula Eskett (District Libraries Manager)**

274-285

RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Receives** Report No. GOV-01-04/220804133482.

(b) **Notes** the customer service improvements, community feedback, events, and use of New Zealand Libraries Partnership Programme funding to contribute positively to community outcomes by Waimakariri Libraries from 7 May – 4 August 2022

(c) **Notes** COVID-19 impact on the Libraries staffing has now generated four 2-4 hour disruptions to opening hours, outside of the mandated lockdowns.

(d) **Circulates** the report to the Community Boards for their information.

6.5 **Aquatics July 2022 Update – Matthew Greenwood (Aquatics Manager)**

286-292

RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Receives** Report No. 220727127656.

(b) **Notes** Aquatic Facilities progress against key performance indicators including Financial results, Customer Attendance and Satisfaction.

(c) **Notes** that lockdowns, head count restrictions and community spread has had a significant impact on customer attendance over the past three years.

(d) **Notes** that the impacts on service from covid, after savings in costs, saw a final result of $302,000 behind budget which will be balanced against the covid loan.

(e) **Notes** the development of a number of initiatives and collaboration within the recreation sector with an aim to engage the wider community in wellbeing and healthy habits which will drive attendance within our facilities going forward.

7 CORRESPONDENCE

Nil.

8 PORTFOLIO UPDATES

8.1 **Greenspace (Parks, Reserves and Sports Grounds) – Councillor Robbie Brine.**

8.2 **Community Facilities (including Aquatic Centres, Multi-use Sports Stadium, Libraries/Service Centres, Town Halls, Museums and Community Housing) – Councillor Wendy Doody.**

8.3 **Community Development and Wellbeing – Councillor Wendy Doody.**

8.4 **Arts and Culture – Councillor Al Blackie.**

9 QUESTIONS

10 URGENT GENERAL BUSINESS

11 MATTERS TO BE CONSIDERED WITH THE PUBLIC EXCLUDED

Section 48, Local Government Official Information and Meetings Act 1987

RECOMMENDATION

THAT the public be excluded from the following parts of the proceedings of this meeting.

The general subject of the matter to be considered while the public is excluded, the reason for passing this resolution in relation to the matter and the specific grounds under section 48(1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution, are as follows:

Item Nº	**Report for Information:**	**General subject of each matter to be considered**	**Reason for passing this resolution in relation to each matter**	**Ground(s) under section 48(1) for the passing of this resolution**
11.1	Report of C Brown (General manager Community and Recreation)	Mainpower Stadium	Good reason to withhold exists under Section 7	Section 48(1)(a)
11.2	Report of C Brown (General Manager Community and Recreation)	Mainpower – Coldstream Hockey Turf	Good reason to withhold exists under Section 7	Section 48(1)(a)

This resolution is made in reliance on section 48(1)(a) of the Local Government Official Information and Meetings Act 1987, and the particular interest or interests protected by Section 6 or Section 7 of that Act which would be prejudiced by the holding of the whole or relevant part of the proceedings of the meeting in public are as follows:

Item Nº	**Reason for protection of interests**	**Ref NZS 9202:2003 Appendix A**
11.1 & 11.2	Protection of privacy of natural persons To carry out commercial activities without prejudice	A2(a) A2(b)ii

WAIMAKARIRI DISTICT COUNCIL

MINUTES OF THE MEETING OF THE COMMUNITY AND RECREATION COMMITTEE HELD IN THE COUNCIL CHAMBER, 215 HIGH STREET, RANGIORA, ON TUESDAY 19 JULY 2022 AT 1PM.

PRESENT

Councillor N Mealings (Chairperson), Mayor D Gordon, Councillor R Brine, Councillor W Doody and Councillor P Redmond.

IN ATTENDANCE

Councillor P Williams.

J Millward (Acting Chief Executive), C Brown (General Manager Community and Recreation), G MacLeod (Community Greenspace Manager), P Eskett (District Libraries Manager), T Sturley (Community Team Manager) and C Fowler-Jenkins (Governance Support Officer).

1 APOLOGIES

Moved: Councillor R Brine Seconded: Councillor W Doody

THAT an apology for absence be received and sustained from Councillor A Blackie, and an apology for lateness be received and sustained from Councillor Williams.

CARRIED

2 CONFLICTS OF INTEREST

There were no conflicts declared.

3 CONFIRMATION OF MINUTES

3.1 Minutes of the meeting of the Community and Recreation Committee held on 31 May 2022

Moved: Councillor Doody Seconded: Councillor Redmond

THAT the Community and Recreation Committee:

(a) **Confirms** the circulated Minutes of the meeting of the Community and Recreation Committee, held on 31 May 2022, as a true and accurate record.

CARRIED

4 MATTERS ARISING

Nil.

5 DEPUTATIONS

5.1 Kaiapoi Food Forest – Brent Cairns

B Cairns thanked the Committee for the opportunity to address them about the Kaiapoi Food Forest (the Forest). He noted that the Poū had been installed at the Forest, thereby linking Kaiapoi as one of New Zealand's most important historic trading posts for food and pounamu. Kaiapoi Food Forrest Trust (the Trust) had done much education during the last five years on building the Forest. However, the actual time spent on building the Forest was decreasing, whereas the growth of their education programmes was increasing.

B Cairns advised that the Trust had presented to the Kaiapoi-Tuahiwi Community Board about erecting a covered open education workshop area. They now also had a toilet on site. The Trust was part of the Food Secure Communities North Canterbury, which had received funding from the Ministry of Social Development, and a small portion of this funds would be used to fund the project. The remaining funding would be sourced externally. He noted that the Trust had access to many volunteer labour to erect the building.

Regarding education, B Cairns reported that during the last year, they had twenty-three requests to assist with establishing food forests throughout Canterbury, the most successful was in Hanmer Springs. The Trust would like to implement a similar model to the food forest in Hanmer Springs in the Waimakariri District, where residents did not need a License to Occupy to create a food forest. Residents in Woodend and Pegasus were interested in setting up a scaled-down food forest at Gladstone Park. Approximately 150 people also approached the Trust from Rangiora that would like to set up a small food forest in one of the local parks. The Trust was suggesting that instead of residents going through the process of setting up an incorporated society or a charitable trust, they could work with the Council's Greenspace Team to take over a small portion of a park for setting up a food forest.

In conclusion, B Cairns explained that they were restructuring the Trust. He noted that he would be stepping down as the Trust's Chairperson and would only focus on the Forest's management.

Councillor Doody enquired if the food forest had been successful in planting kumara. B Cairns responded that the kumara was planted too late, hence they still formed but not as large.

Mayor Gordon thanked B Cairns for the work that he had done on this project and noted that one day he would look back on the project with a sense of pride. He commended the addition of the Poū to the food forest.

Councillor Mealings endorsed Mayor Gordon's comments. She applauded B Cairns' relentless enthusiasm in the face of all odds to establish a food forest. Also, to roll out the initiative to other interested areas in Canterbury. The way that Trust brought together communities from all walks of life was phenomenal, she again thanked him for his efforts.

Councillor Mealings questioned if the Trust was still presenting online courses. B Cairns explained that they were trying not to replicate work, the videos would still be online. He was also setting up another website to assist food forests which would include online courses that people could undertake.

Councillor Mealings further noted that 40 to 50 trees had recently been stolen from the food forest and asked if it was the native shelter. B Cairns confirmed that it was a native shelter. Southern Woods Nurseries approached the food forest and asked if they wanted a pile of natives, which he collected and shared with the Kaiapoi East Residents Association. The association planted

them in the red zone in Kaiapoi, and the other trees were planted along the food forests windbreak, however, these trees were stolen soon after planting.

6 REPORTS

6.1 Arts Strategy Development Report – T Sturley (Community Team Manager)

T Sturley spoke to the report noting it provided an overview of the progress in developing a Waimakariri District Arts Strategy. This work was currently being facilitated as part of the Community Development Special Projects Portfolio, which essentially dealt with Coivd-19 recovery projects. The idea of developing a district-wide Arts Strategy came from a Covid Recovery Forum held in 2021. The Council had received $32,200 from Creative Communities New Zealand to fund the development of an Arts Strategy. Staff believed that this work would provide an opportunity for the arts to play a role not only in the social recovery of the district but also in the district's general attraction and economic development.

T Sturley noted that given the rich Maori heritage of the Waimakariri District it was important that the Council applied a bi-cultural approach to the development of the strategy, so staff had approached Mahaanui Kurataiao for assistance to navigate the best process. A survey had been developed for the Council to gain insight into the public perception of art developments in people's lives, opportunities as seen by the public, and the levels at which the public may engage. A separate survey was developed to capture the local arts sector's issues, aspirations and needs. The surveys would be run via the Council's Let's Talk platform and would also be circulated through some of the Community Team's networks and the libraries.

In conclusion, T Sturley highlighted the process undertaken in developing the Arts Strategy spearheaded by Councillor Blackie as the Arts Portfolio Holder.

Moved: Mayor Gordon Seconded: Councillor Doody

THAT the Community and Recreation Committee:

(a) **Receives** report No. 220707116011.

(b) **Notes** that staff acquired $32,200 from Creative New Zealand to resource Community Development staffing hours, fixed term, to see the project through to its completion in 2023.

(c) **Notes** the collaborative approach that would be applied to the development of the Arts Strategy.

(d) **Notes** that, in preparing toward this piece of work, staff investigated strategies adopted in other, similarly sized communities across the motu; particularly Whanganui District and Dunedin City.

(e) **Notes** that Councillor Al Blackie was the appointed portfolio holder for this project.

(f) **Notes** that staff had approached Mahaanui Kurataiao Ltd (MKT) to identify the most appropriate way forward in ensuring a bicultural, partnership approach was applied to the development of the Arts Strategy.

(g) **Notes** progress to date, including a mapping of the local arts sector, establishment of a Project Control Group to guide the process, and development of stakeholder surveys, seeking feedback from both the local arts sector and the wider community.

CARRIED

Mayor Gordon thanked Councillor Blackie for leading this initiative and T Sturley for the work being done. He believed it was the right time to develop an Arts Strategy for the district. He commented that the Creative Communities New Zealand funding was welcomed because the district was home to many arts organisations that struggled with funding, such as the Oxford Arts Gallery. There was a strong focus on the arts throughout the community and the Council, therefore, needed to consider the next steps in developing the arts.

Councillor Doody supported the project and felt that any initiative to improve the art and culture in the district was important. She noted that at the Audit and Risk Committee meeting on 19 July 2022, Enterprise North Canterbury talked about their applications to Creative Communities New Zealand for developing two movies. She thought that the Arts Strategy may assist them with the process.

Councillor Mealings thanked T Sturley for her report, noting that this was important work and was right on time. She applauded the staff for securing the $32,200 grant to facilitate the project. She also commended them for liaising with the local Rūnanga before public consultation. She commented that Councillor Blackie was perfectly suited to this role.

6.2 Aquatics July 2022 Update – M Greenwood (Aquatics Manager)

C Brown spoke to the report noting the effort to keep the service levels at the Aquatic Facilities as they were. Communication had been excellent in letting the public know when the facilities would close early, although this had not happened often. However, he noted that attendance numbers were down, which was attributed to people in the community isolating due to Covid or other sessional illnesses. There was, unfortunately, nothing that staff could do about this other than try their best to keep the facilities open.

C Brown noted that the Council would introduce several improvements over the next six months to further increase the standard and quality of its Waiswim Learn to Swim Programme. Skills Active, the Industry Training Organisation, had been working with the Council to develop an in-house training programme that was unit standard based and delivered high-quality, consistent results. The Council would therefore be able to run its own internal training lifeguard courses that could be tailored to our community's needs.

Councillor Williams noted there had been several young surf lifesavers that did not quite qualify to serve as lifeguards. He asked if staff had considered training these young people to prepare them for emergencies. C Brown noted that many of the young people were underage, so the Council could not allow them to work as they did not meet the current standards for being in that environment. However, the people could be contacted so that they knew that they could access extra training to become lifeguards when they reached the right age. The recruitment campaigns undertaken this year had been successful in terms of having access to enough people to man facilities. The next recruitment campaign would be to man the Oxford facility during the summer, so keeping in contact with those surf lifesavers could be key.

Furthermore, P Williams noted that some of the surf lifesavers coming of age in summer 2022 could still be trained. If they did the training now, they would be available when staff needed them in November 2022. C Brown noted that M Greenwood had been working with Human Resources on a talent pool that staff could draw from, however, the surf lifesavers could not be brought in till they came of age.

Councillor Redmond questioned if the notable decline in attendance numbers at the Kaiapoi and Dudley facilities would significantly affect the Aquatic facilities' budgets. C Brown explained that it would affect the income, some of the Learn to Swim participants that had already paid but did not turn up for several sessions sometimes got refunded. In addition, recreational swimming was also down, directly affecting the income.

Councillor Mealings enquired if the proposed new training framework would follow through to change the Learn to Swim Grading Framework. C Brown was unsure, however, he advised that the training framework focused more on staff training as opposed to the grading of kids and adults.

Moved: Councillor Doody Seconded: Councillor Redmond

THAT the Community and Recreation Committee:

(a) **Receives** Report No. 220627108943.

(b) **Notes** Aquatic Facilities progress against key performance indicators including Financial results, Water Quality and Customer Satisfaction.

(c) **Notes** the efforts taken to maintain service levels with the ongoing impact of staff sickness.

(d) **Notes** updated training practices for Waiswim staff to ensure the Council continued to deliver a high quality robust programme which meets community need.

CARRIED

Councillor Doody thanked M Greenwood for the work being done and acknowledged the pressures that he and the Aquatics Team had been under for some time.

Councillor Redmond commended the staff and M Greenwood for working in difficult times and maintaining almost 100% service levels in these circumstances. However, he commented that the Council needed to be conscious that some community members may consider blaming Covid for lack of service as an excuse when it was actually very real.

7 CORRESPONDENCE

Nil.

8 PORTFOLIO UPDATES

8.1 Greenspace (Parks, Reserves and Sports Grounds) – Councillor Robbie Brine.

Wind event response from Asplundh.

- Three crews were ready to go out this morning at first light to East side, Oxford and Pegasus.

General

- Capital spending on new burial/ash berms was programmed for Rangiora and Kaiapoi.
- Noted district-wide Capital spending on infill planting i.e. replacement plants in street gardens and reserve.
- Poor Asset Renewal Programme was underway – Multiple seats throughout the District.
- Bollard/cable was installed in selected areas of Pearson Oval to prevent grass berm damage by vehicles.
- Pre tender contract discussions for the Parks and Reserves Maintenance Contract begin this month – new contract would commence on 1 March 2024.
- Tree planting was ongoing.
- The design phase for capital projects was underway for the 22/23 financial year, with forecasting having been drafted, the next step was for Greenspace staff to attend Community Board meetings to outline projects and programs of work over the coming 12 months for each area.
- West Oxford Reserve Toilet was now installed and would be open to the public shortly. The final landscaping around the toilet block was being completed.
- Townsend Playground consultation and design were nearly completed. Final signoff would be taken to Rangiora-Ashley Community Board in September 2022.
- Millton Reserve development was ongoing. Planting day had been organised with the Soroptimists on 10 August 2022 to plant the trees that they donated. The contractor would be back on site in spring once the soil had hardened to complete areas which still need levelling.
- Pathways in the Mahinga Kai reserve within the Kaiapoi Recovery Zone were currently being constructed with an estimated completion of mid-August.
- Opus was surveying Coopers Creek to determine heights and exact property boundaries to inform the development of a master plan for this area.
- Staff were exploring options to resolve the flooding issues at the Pines Oval playground. This may include relocation of the playground. A report would be submitted to the Community and Recreation Committee in either August or September 2022.
- Staff were organising a trial for a product to be used for the rowing access way at Murphy Park. This would be put in the river for a few weeks in mid-August 2022 to determine if it was the best product for the job.
- The Council's ecologists were going to trial a plot of grasses that required less maintenance, more detail to follow as this progressed.

Silverstream Reserve footbridge installed

- The recent installation of the new footbridge at Silverstream Reserve had been a great addition to the reserve and met the local community's aspirations.

Taranaki Reserve – inanga spawning site planted (ZIPA funded)

- The recently re-profiled banks of Taranaki Stream adjacent to the flood gates at the estuary had now been planted by the rangers. The 800 seedlings were mostly wetland species, many of which had adapted to the intertidal zone with temporary water inundation providing habitat for inanga.

Huria Reserve/Mahinga kai site winter planting completed

- After the inaugural community planting at Huria Reserve in May 2022, the rangers continued to plan the remainder of the 2000 seedlings plus an additional 2,000 seedlings donated by Environment Canterbury.

8.2 **Community Facilities (including Aquatic Centres, Multi-use Sports Stadium, Libraries/Service Centres, Town Halls, Museums and Community Housing) – Councillor Wendy Doody.**

- The Community Networking Forum in Oxford was excellent.
- Matariki celebrations in Oxford were wonderful. She commended the Oxford Promotions Association on organising this event. The children's light story at the Oxford Library was also a success.
- She accompanied Mayor Gordon and Councillor Mealings to Oxford to judge the Lights Festival, which was very interesting as people had done much work decorating their houses. .
- She noted that she had been delighted with the Storywalks® at the Northbrook Wetlands. So many families along the walk took their children to read the 'Little Kiwi's Matariki' on all the placards.
- She was pleased about the west Oxford toilet.

Mayor Gordon questioned if the Storywalks® could become a permanent fixture because it was a fantastic initiative and the interpretive panels meant a lot to people. G MacLeod explained that staff were assessing this trial event's success, operational impact and costs. If the Council could make the signs out of something more durable, operational costs would be reduced. P Eskett would be bringing a report on the Storywalks® to the Committee's August 2022 meeting.

8.3 **Community Development and Wellbeing – Councillor Wendy Doody.**

See above.

8.4 **Arts and Culture – Councillor Al Blackie.**

Nil.

9 QUESTIONS

Nil.

10 URGENT GENERAL BUSINESS

Nil.

11 MATTERS TO BE CONSIDERED WITH THE PUBLIC EXCLUDED

Section 48, Local Government Official Information and Meetings Act 1987

Moved: Councillor Doody Seconded: Councillor Brine

THAT the public be excluded from the following parts of the proceedings of this meeting.

CARRIED

The general subject of the matter to be considered while the public was excluded, the reason for passing this resolution in relation to the matter and the specific grounds under section 48(1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution, were as follows:

Item Nº	Report for Information:	General subject of each matter to be considered	Reason for passing this resolution in relation to each matter	Ground(s) under section 48(1) for the passing of this resolution
11.1	Report from MTO	Report for Information	Good reason to withhold exists under Section 7	Section 48(1)(a)

This resolution was made in reliance on section 48(1)(a) of the Local Government Official Information and Meetings Act 1987, and the particular interest or interests protected by Section 6 or Section 7 of that Act which would be prejudiced by the holding of the whole or relevant part of the proceedings of the meeting in public were as follows:

Item Nº	Reason for protection of interests	Ref NZS 9202:2003 Appendix A
11.1	Protection of privacy of natural persons To carry out commercial activities without prejudice	A2(a) A2(b)ii

CLOSED MEETING

Resolution to resume in Open Meeting

Moved: Councillor Brine Seconded: Mayor Gordon

11.1 **CON 2022/04 - Maria Andrews Toilet Block Upgrade**

THAT the Community and Recreation Committee:

(a) **Receives** the information in Item 11.1 and the business discussed with the public excluded remains public excluded.

The public excluded portion of the meeting took place from 1.49pm to 1.55pm.

THERE BEING NO FURTHER BUSINESS, THE MEETING WAS CLOSED AT 1.55pm.

CONFIRMED

Chairperson

Date

WAIMAKARIRI DISTRICT COUNCIL

REPORT FOR DECISION

FILE NO and TRIM NO:	CPR-04-05-15 / 220622106548
REPORT TO:	COMMUNITY AND RECREATION COMMITTEE
DATE OF MEETING:	16th August 2022
AUTHOR(S):	Andy Coker
SUBJECT:	West Eyreton Rifle Club – Feasibility Report
ENDORSED BY: (for Reports to Council, Committees or Boards)	General Manager / Acting Chief Executive

1. SUMMARY

1.1. The purpose of this report is to provide recommendations on the viability of relocating West Eyreton Rifle Club from Cust Community Centre to Pearson Park Pavilion as a result of a submission to the 2021 LTP submission from West Eyreton Rifle Club.

1.2. Staff have reviewed/assessed the following options; Cust Community Centre, Pearson Park Pavilion & a new purpose built facility.

1.3. Staff have worked with West Eyreton Rifle Club and Target Shooting New Zealand to establish the compliance requirements for the new site.

1.4. Staff have kept the Oxford-Ohoka Community Board informed of progress via a Memo issued 9th Dec 2021 (*TRIM 211129190328*). This memo informed the board that the report would be taken to the Committee and Recreation Committee and made available to the board.

1.5. West Eyreton Rifle Club have engaged with Oxford Area School to investigate opportunities around demand from Students for a School Shooting Club in conjunction with the Club. The feedback was positive and the School do have Students that want to take part in organised Indoor Target Shooting up to two days a week. In addition, the Club believe the previous members of the Oxford Rifle Club will take up membership, as there is still a strong base in existence.

Attachments:

i. West Eyreton Small Bore Rifle Club Submission to Waimakariri District Council
ii. Target Shooting New Zealand Compliance Report - Cust Community Centre
iii. Target Shooting New Zealand Compliance Specification
iv. Contamination Report – AECOM
v. Concept Mechanical Design

2. RECOMMENDATION

THAT the Community and Recreation Committee:

(a) **Receives** Report No. 220622106548

(b) **Approves** the relocation of West Eyreton Rifle Club to Pearson Park Pavilion from Cust Community Centre

(c) **Approves** that Staff proceed to draft and execute an agreement between WDC and West Eyreton Rifle Club for the occupation of the Pearson Park Rifle Range.

(d) **Approves** that Staff utilise the remaining balance of $8,823.74 from the allocated budget for a feasibility study ($20,000.00) as seed money to facilitate the upgrades required to bring the building up to compliance standards.

(e) **Approves** that Staff allocate a further $6,176.26 from the General Renewals Budget to repair/replace the existing lighting within the range that is due for renewal and supplement the balance of monies from the feasibility study, as detailed in recommendation (c)

(f) **Notes** the recommendation for the relocation to Pearson Park Pavilion is a result of an analysis of three options; remaining in their existing location (Cust Community Centre), relocating to Pearson Park Pavilion (*former Oxford Miniature Rifle Club range*) or constructing a purpose built facility in the area.

(g) **Notes** Staff will continue to work with West Eyreton Rifle Club to ensure the transition works with both the Club and existing users of Pearson Park Pavilion.

(h) **Notes** the recommendations in this report are relevant to the following community outcomes; Public spaces and facilities are plentiful, accessible and high quality, and reflect cultural identity SDG 3, 11 & Core utility services are sustainable, resilient, affordable; and provided in a timely manner SDG 11, 12

3. BACKGROUND

3.1. West Eyreton Small bore Rifle Club (WESRC) have been in occupation of Cust Community Centre since the building was constructed and prior to this occupied a site in West Eyreton. The club has been in existence for circa 73 years. WESRC typically occupy the club in the winter months from Feb – Sept each year.

3.2. The shooting activity was delivered within the centre by utilising the main hall area with fixed targets being underneath the stage where the bullet traps are located. The nature of this operation resulted in a build-up of lead exposure and contamination to the bullet trap area and half the main hall. As part of the centre's refurbishment works the areas had to be professionally cleaned and sealed to ensure contamination was below permitted levels under the Ministry of Health lead guidelines. On reflection of the ongoing use and review of the Target Shooting New Zealand (*TSNZ*) audit report completed as part of the Club's compliance process. The club decided that all these compliance requirements are too great (*Cost & HS&E*) and therefore have gone into recess until a resolution could be found.

3.3. As part of the 2021 LTP, West Eyreton Small Bore Rifle Club (WESBRC) submitted a proposal to relocate club to Oxford and the decision was made to undertake a review of the options available.

3.4. Oxford Rifle Range in Pearson Park Pavilion was utilised by Oxford Miniature Rifle Club and was affiliated to Ashley Association. The Oxford area school used the facility for general shooting practice and inter-school competitions. At the time there was a change in members and teachers in the club and school and as a result participation fell and the club was disbanded.

3.5. The physical structure of the range is still in a useable condition with the Earthquake repairs being completed by the regeneration programme. There is some historical lead contamination present with the range which has been confirmed by appended Contamination report from AECOM. However, the casting of a concrete slab to the range would be sufficient to cap and seal the space for future use.

4. ISSUES AND OPTIONS

4.1. Staff have assessed the options available and concluded the following;

4.1.1. **Cust Community Centre** – The TSNZ compliance standards and associated works needed to bring this shared facility up to code is considerable, putting the

Club's financial viability at risk. This coupled with the increased operational management and health & safety, due to the shared facility with other users, means that this building is unworkable. Staff believe that this option would be cost prohibitive and feel that it would too great a responsibility for the Club to manage the safety processes in a shared facility.

4.1.2. **Pearson Park Pavilion** – The key benefit of this option is the base structure for the range is already in place. Upgrades are required to bring the space up to current compliance requirements as stipulated by Target Shooting New Zealand (TSNZ). This are as follows;

- Cast a sealed concrete slab – ($18,600.00 estimate)
- Install Mechanical Ventilation - $13,224.50
- Seal/Paint the existing blockwork walls ($5,000.00)
- Install LED Lighting to Range (5,000.00 estimate)
- Safety Systems ($5,000.00 estimate)

The concrete slab seals the existing subfloor and enables a cleanable surface along with the painting of the blockwork walls. The range is required to be fully cleaned after every shooting event to ensure that no residual lead dust is present, in line with the new legislation.

Mechanical Ventilation will be introduced to create an environment of positive pressure. This forces the airborne lead residue out of the building and provides an increase in air change frequency to ensure that fresh air is constantly supplied.

Another advantage to utilising Pearson Park Pavilion is that the range is a separate annex to the main hall. This means that the shooting activity is separated, so the cross contamination will be mitigated and the risk to the safety of other users is dramatically reduced.

Staff engaged Powell Fenwick to provide a concept design for the ventilation system in order to have this costed ($13,224.50). Staff recommend that the remaining balance of the feasibility budget be used to pay for these Mechanical works to support the Club's relocation and ensure that Council protect the asset from future contamination. The rest of the scope would be the responsibility of WESBRC to raise through funding, grants and local support.

4.1.3. **New Purpose Built Facility** – based on the area of the existing range in Pearson Park Pavilion including clubrooms and welfare facilities (200m2) using current construction rates of $5000 p/m2 (*including professional fees*), the construction of a new facility would equate to $1,000,000.00 (*not including escalations*). Staff believe this option is not viable with the current membership numbers (*including forecasted membership*) and that the financial position of the club would not be able to support this expenditure.

4.2. Staff have considered all the options above and concluded that the most cost efficient solution would be to re-activate the range at Pearson Park Pavilion. The skeleton structure is already present and there is only a small amount of upgrade work required to bring the building up to TSNZ compliance standards. In addition, the range is an annex to the main building, therefore the risk to other users can be managed in a safer way than utilising a shared facility. Staff will work with the Club to develop an agreement that clearly identifies the clubs obligation around lead management and using the shared facilities with other users.

4.3. Staff note that the Pearson Park Pavilion's kitchen and supper room will need to be utilised as a club room for WESBRC. Staff will work with all users to enable the club and other users to use the space collectively.

4.4. For the purpose of completeness of this report there is one further option that staff believe should be noted, but feel is not beneficial to the Community and western side of the district. There is an option that West Eyreton Rifle Club is amalgamated with Rangiora small bore Rifle Club and thus West Eyreton Club would cease to exist. Staff do not advocate for this option due to the long standing history of the club.

Implications for Community Wellbeing

There are implications on community wellbeing by the issues and options that are the subject matter of this report.

The options identified in this report will provide positive impact on Community Wellbeing by providing the facilities to cater for a localised recreational activity, where otherwise members would need to travel outside of the Oxford Area to participate.

4.5. The Management Team has reviewed this report and support the recommendations.

5. COMMUNITY VIEWS

5.1. Mana whenua

Te Ngāi Tūāhuriri hapū are not likely to be affected by, or have an interest in the subject matter of this report.

5.2. Groups and Organisations

There are groups and organisations likely to be affected by, or to have an interest in the subject matter of this report.

Staff have kept the Oxford-Ohoka Community Board informed of progress via a Memo issued 9th Dec 2021 (*TRIM 211129190328*). This memo informed the board that the report would be taken to the Committee and Recreation Committee and made available to the board.

Staff further briefed the Oxford-Ohoka Community Board on the recommendations intended for this report on 3rd August 2022 with no objections.

The Pearson Park Advisory Group (PPAG) have an interest in this report as the group responsible for providing local input to the management of the reserve, community halls and facilities. The enhancement of the facilities on the reserve will only widen the opportunities available to the Community which will have a positive impact to wellbeing to the Oxford District.

Staff have engaged with the PPAG with no objections other minor clarifications around the co-ordination with other users groups and the seismic status of the range. Staff confirmed to the group that Club sessions would be co-ordinated with the others users to avoid conflict and the Club's MOU would be drafted to reflect these obligations. Staff also confirmed to the group that the range was seismically strengthened as part of the main building improvements.

The West Eyreton Small Bore Rifle Club have an interest in the outcome of this report as it directly impacts the clubs ability to continue to operate. The club are currently in recess due to not having a location to shoot.

Wider Community

The wider community is not likely to be affected by, or to have an interest in the subject matter of this report.

6. OTHER IMPLICATIONS AND RISK MANAGEMENT

6.1. Financial Implications

There are financial implications of the decisions sought by this report.

6.1.1. The upgrade works will have a financial impact on the club. However they feel confident that with their connections within the local community they will be able to deliver what is required.

6.1.2. As part of the LTP, Council set aside $20k for a feasibility study. To date staff have expended $11,176.00 of this and do not foresee any further expenditure in order to conclude their recommendations. On this basis Staff recommend that the remaining $8,823.74 be used as seed funds for West Eyreton Small Bore Rifle Club to support them in the upgrade works.

6.1.3. In addition, staff recommend that a further $6,176.26 be funded from the General Building Renewals budget to support the asset replacement of the existing lighting in the Range and supplement the seed funding to deliver the new ventilation. Staff recommend that all other work be funded and delivered by West Eyreton Small Bore Rifle Club. This budget is included in the Annual Plan/Long Term Plan.

6.2. Sustainability and Climate Change Impacts

The recommendations in this report do have sustainability and/or climate change impacts.

The works detailed in this report will have an impact on sustainability as all construction work has potential sustainability implications. Staff will ensure that the impact is mitigated where possible. Where this is unavoidable, staff will work with engineers, contractors and suppliers to keep the impact to a minimum.

6.3 Risk Management

There are risks arising from the adoption/implementation of the recommendations in this report.

There is a risk around the sustainability of West Eyreton Small Bore Rifle Club and its ongoing membership base. Staff have engaged with the Chair of the club to ascertain what their expectation is with the relocation and they have provided the following commentary.

"I see future users Oxford Area School. When they were shooting at Cust they had 8 to 10 students each week for the school term. We would also host the Fire brigade shoot plus any other group that wanted to experience shooting such as Scouts local youth group etc. Also as a community activity we would encourage a business house competition run over 6 weeks. I think overall this will be well attended by the community due to the strict discipline of the sport and mental challenge"

The above complementary to feedback from the existing membership base. On this basis, staff do believe that the risk of the club failing is low, but not mitigated completely.

Whilst the staff are recommending some contribution to funding ($15,000.00) and the Club feel confident that they have the ability to fund raise for the balance ($31,824.50 estimated). Staff believe that there is still a risk that the Club may fall short and could require some further contribution from Council. This should be reviewed once the Club have had the balance of the works fully costed. Staff will also provide support through the Community Team in regards to options around external funding strategy as part of Council's support for the Club.

6.3 **Health and Safety**

There are health and safety risks arising from the adoption/implementation of the recommendations in this report.

6.2.1. The potential for lead contamination and associated lead management with the activity of Indoor Target Shooting has Health & Safety risks. There are strict compliance criteria stipulated by Target Shooting New Zealand (TSNZ) in conjunction with the Ministry of Health. The Club will be audited by TSNZ annually to ensure the mitigation and cleaning processes are put in place and are adhered to. In order to protect the asset, staff will draft special conditions within the agreement to set out the clubs obligations.

6.2.2. The nature of gun sports has an inherent safety risk to members participating and other users of the facility. Staff will work with the club and TSNZ to work through their operating procedures to ensure that the activity is controlled and safe. Staff will then work with the Club to understand how their operations will impact the other users and then implement additional processes to enable cohabiting of the building.

6.2.3. Staff will draft conditions around these risks (*6.2.1 & 6.2.2*) within a Memorandum of Use (MOU) or Licence to Occupy (LTO) to ensure there is rigour around the club obligations to ensure the safety under Target Shooting New Zealand (TSNZ) and Health & Wellbeing under the Ministry of Health. Staff will draft conditions stipulating the Club is responsible for having their lead management processes audited to confirm the management is effective and Council will not be burdened with any contamination remediation. The safety aspect will be audited annually by TSNZ and should be formally issued to Council as a condition of the agreement.

7. CONTEXT

7.1. **Consistency with Policy**

This matter is not a matter of significance in terms of the Council's Significance and Engagement Policy.

7.2. **Authorising Legislation**

The Building Act 2004 is relevant in this matter

7.3. **Consistency with Community Outcomes**

The Council's community outcomes are relevant to the actions arising from recommendations in this report.

Public spaces and facilities are plentiful, accessible and high quality, and reflect cultural identity SDG 3, 11.

There is a wide variety of public places and spaces to meet people's needs

There are wide-ranging opportunities for people to enjoy the outdoors

The accessibility of community and recreation facilities meets

Core utility services are sustainable, resilient, affordable; and provided in a timely manner SDG 11, 12

Good procurement practice and effective long-term planning ensures services are sustainable, affordable and value for money for the community

7.4. **Authorising Delegations**

The Committee and Recreation Committee has the delegated authority to receive this report and approve award of contract, on behalf of the Council.

Submission to Waimakariri District Council

From West Eyreton Smallbore Rifle Club (WESRC)Subject: The ongoing use by the Rifle club of the Cust Community Centre or Alternative Facility

Brief history of the Rifle Club: Established approx. 72 years ago the club first operated from West Eyreton Hall.
When the council proposed building the Cust community Centre, the WESRC was approached to move from their existing site so there would be enough users to support the proposal for the Centre. In order to do this, the members did a lot of fundraising resulting in Club rooms being constructed upstairs in the hall as well as bullet traps being constructed under the stage. The Club to this day still operates during the winter months from the end of February to the end of September each year.

Club Members: Our Patron is Richard Spencer Bower who has been an active shooter of the club for many years.
In recent years we have had one of our club Juniors represent New Zealand at the International Oceania Games held in Australia.
Other Juniors of the club have shot in the New Zealand secondary school competition and one was captain of the South Island Team.
Some of the female members have represented in the South Island teams and represented New Zealand internationally
Some veterans members of the club represented the South Island Teams

Community Resources: The local Cust fire brigade shoot at the club as does the Oxford Fire Brigade so they can enter the NZ wide competition the service holds.

In the past, the Oxford Area school has brought students, teachers and overseas students to gain and experience shooting a target rifle and learning the correct handling of a rifle.

It was intended to run a local business house shooting competition however covid and hall alterations put that in abeyance at present.

The club is open to all residents of the community and anyone can come along and have a try after the appropriate safety instructions

The Club room walls host many pictures of club members and teams sporting achievements both nationally and internationally.

This year, the Club was approached by the Oxford Area School to train students who would like to develop their shooting ability. The School is interested in working with us (preferably in the Oxford area) and we see this as an exciting opportunity for youth in the Oxford area.

Current issues: Over recent years the health and safety requirements of shooting facilities has been highlighted and this has led to the realisation that our presence at Cust Community Centre comes with a raft of challenges in order to ensure the safety of both our members and other users of the centre.

There are many issues to consider with clubs operating from a shared community facility. The two major ones are lead contamination and the air purification of the facility.

Target Shooting New Zealand has viewed the range in the Cust Community Centre and has highlighted a number of alterations required to obtain range certification.

-The complete back wall needs to have steel plates up to a certain height plus ply wood coverings to stop any bullets missing the traps under the stage.

- Each side of the hall needs to have about 1-meter-wide wings attached to the steel framing for the same purpose.

-Steel is needed to protect the lights currently used to light the targets

-Air purification - this involves a negative air flow over the shooters while shooting is in progress. A quote was obtained for this. Estimated cost $15,000.

-Strict cleaning processes are required to clean any lead contamination from the floor surface after each shoot. Recommended that a wet vac system with a hepi filter is used rather than just the current sweeping of the floor.

-Strict safety, procedures and processes while shooting is in progress. With the change of the locks and safety doors these procedures now need upgrading.

The potential cost of upgrading to the standards required (especially in a shared facility) have a major risk of putting the club's viability into question.

The members are also concerned that continuing Health and safety requirements and also public perception in the future, will only make it more and more difficult for the Club to operate in a shared use facility.

In the greater Christchurch Area there are only two clubs operating in shared facilities.

The Proposal: That Council consider:

- The possibility of the WERC giving up using the Cust Community Centre facilities and support the club to move to the Oxford Shooting Range (being a dedicated range facility).
- That as part of the move, new clubrooms be created by establishing a partitioned area within the existing building that is attached to the Oxford Rifle Range.

By doing so, the many issues that have been highlighted will be mitigated by no longer using a shared community facility.

Oxford Shooting Range:

The Oxford Miniature Rifle Club operated from this range for many years and was part of the Ashley Association. The Oxford Area School shot at this range and used this for ongoing inter=school' competitions.

Time, teachers changing and age of members eventually saw the club closing and the Range no longer being used even though, the facilities were there. The club rifles at the time were given to WESRC to ensure the continuation of the sport in the area.

The earthquake caused damage to the building and shooting range and the Council have fixed the building (but in doing so, damaged the shooting traps which to this date have not been repaired).

To meet requirements now, the Oxford range would need upgrading (however the costs would be significantly less than those required for the Cust Community Centre).

This work would include:
- Emergency lighting (as the walls are concrete block with no windows).
- Air purification (as the air volume is less than Cust, the unit needed would be significantly less costly)
-Safety door) to replace the existing solid wooded door at the rear of the building).
-Work to ensure that the area behind the traps (which is currently used by the Cricket Club for storage), is made safe or locked during use of the range.
-Exposed pipes to be covered

= Small amount of building work to convert a section of the building into a permanent club room area.

The WESRC are seeking approval in principle to shift to the Oxford Shooting Range and to receive financial support to undertake the work required to bring the range and clubrooms up to standard. We would like to speak to our submission before Council, at which point we will have a better understanding of the likely cost of this work.

Submitted by: Peter Boerlage

President West Eyreton Smallbore Rifle Club

Target Shooting New Zealand

Range Inspection – Cust Community Hall – 1.11.19

Range Inspected by: Jackie Lindsay, Bruce Marchant **Report reviewed by:** Ross Mason

Inspection requested by Peter Boerlage (West Eyreton SRC) as major renovations are being planned by Council and advice is sought on appropriate ventilation and safety feature upgrades for continued Smallbore Club use.

Range Owner / Operator: Waimakariri District Council

Range used by West Eyreton Smallbore Rifle Club

Range Location: Cust Community Hall**,** 9 Mill Rd, Cust

Description of Range: (Ranges, Firing Points, Firearms, Ammunition, Ventilation, Targets, Bullet Catchers):

20yd indoor range, 6 firing points. Hall used by community, currently planned for renovations.

Range used for .22 smallbore only.

Targets are hung on sealed wooden frames with angled steel bullet catchers across full width of targets, lead dropping into sand below.

Prior to shooting: carpet mats for firing points placed, doors under stage opened, pillars between doors under stage covered with light coloured chipboard, stairs to stage rolled away 90° and to the side, entry doors from foyer locked.

Storage of all non-used items (old chairs, desks etc) in target area is to be cleaned out.

Amenities: (Range structure, Social Areas, Access, Power, Lights, Heaters)

SEE PLANS and PHOTOS ATTACHED

Exterior is fibreboard,

Renovations planned include: replacing wall heaters and changing 2 entry/exit doors near stage to emergency exit-only crash bar doors.

Red Warning Lights: (Light Operation, Lockouts, Notices)

New red light system planned to be remote-controlled by Range Officer, lights to be at stage floor level.

First Aid / Fire Plan: (First Aid kit, fire exits)

Fire exits to left and right of stage. First Aid kit not looked for

Shooting Procedures: (ROM – RSO clearly displayed)

No – hall is multi-use.

Range Maintenance: (Cleaning, Rubbish, Target refurbishment, Lead clearance)

Bullet catchers cleaned annually.
All rooms and external areas sighted are clean and tidy.

Non Shooting Club Use: (Instructions for outside groups use of range)

Multi-use hall, with the range being a minority user. Council instructions for use not sighted.

Range Security: (Outside doors, Rifle storage, Alarms)

Not examined as part of the brief of this visit. Rifle storage has been moved to upstairs area following recent theft.

Amendments following inspection:

REQUIRED PRIOR TO CERTIFICATION:

Safety upgrades as per plans attached:

1. Replace baffle in front of strip lights and extend down to just above door level, minimum 4mm steel faced with 15mm ply. To extend across entire width of target boards.

2. Place exterior wall protection inside hall at back of stage – minimum 3mm steel faced with 12mm ply. To be from stage floor level to 1.2m high.

3. Steel I-beam 2/3 distance from firing point to stage to be covered on shooter side by 12mm ply.

4. Add wall protection to side walls and door in target area – minimum 3mm steel screwed to walls. To extend from at least 1m below lowest target bull to ceiling in target area.

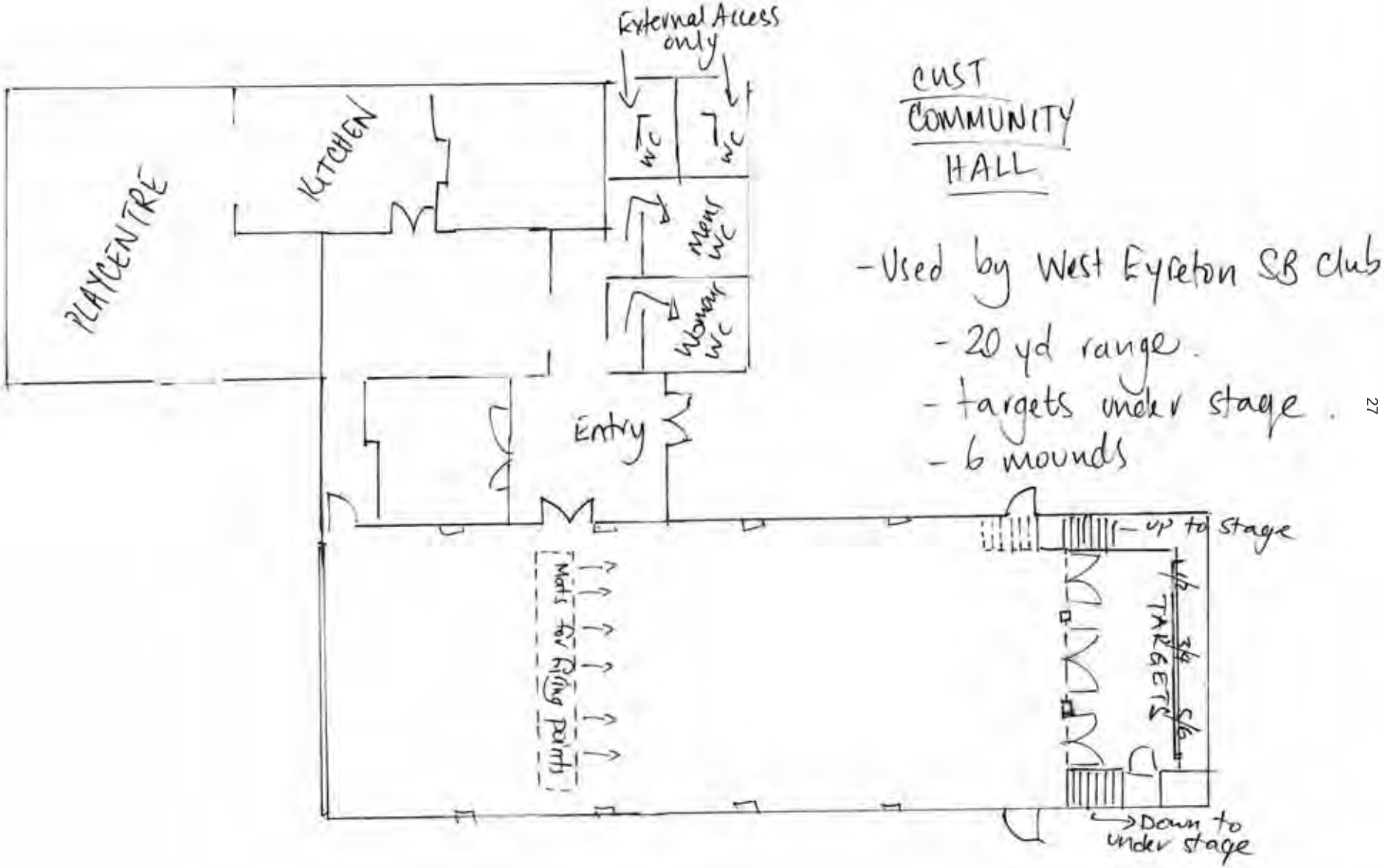
5. External doors near stage to be changed to exit-only as planned, and to have folding baffle hinged to wall of 3mm steel covered by 12mm ply. Baffles to be opened out when shooting so that no part of the doors are visible from the middle of the firing point.

6. Cleaning plan in place – hall floor to be cleaned with good quality HEPA-filtered vacuum cleaner following every shoot. This vacuum cleaner is NOT to be used for any other purpose or hall areas.

7. FURTHER INSPECTION required following final hall upgrade and prior to certification

RECOMMENDED:

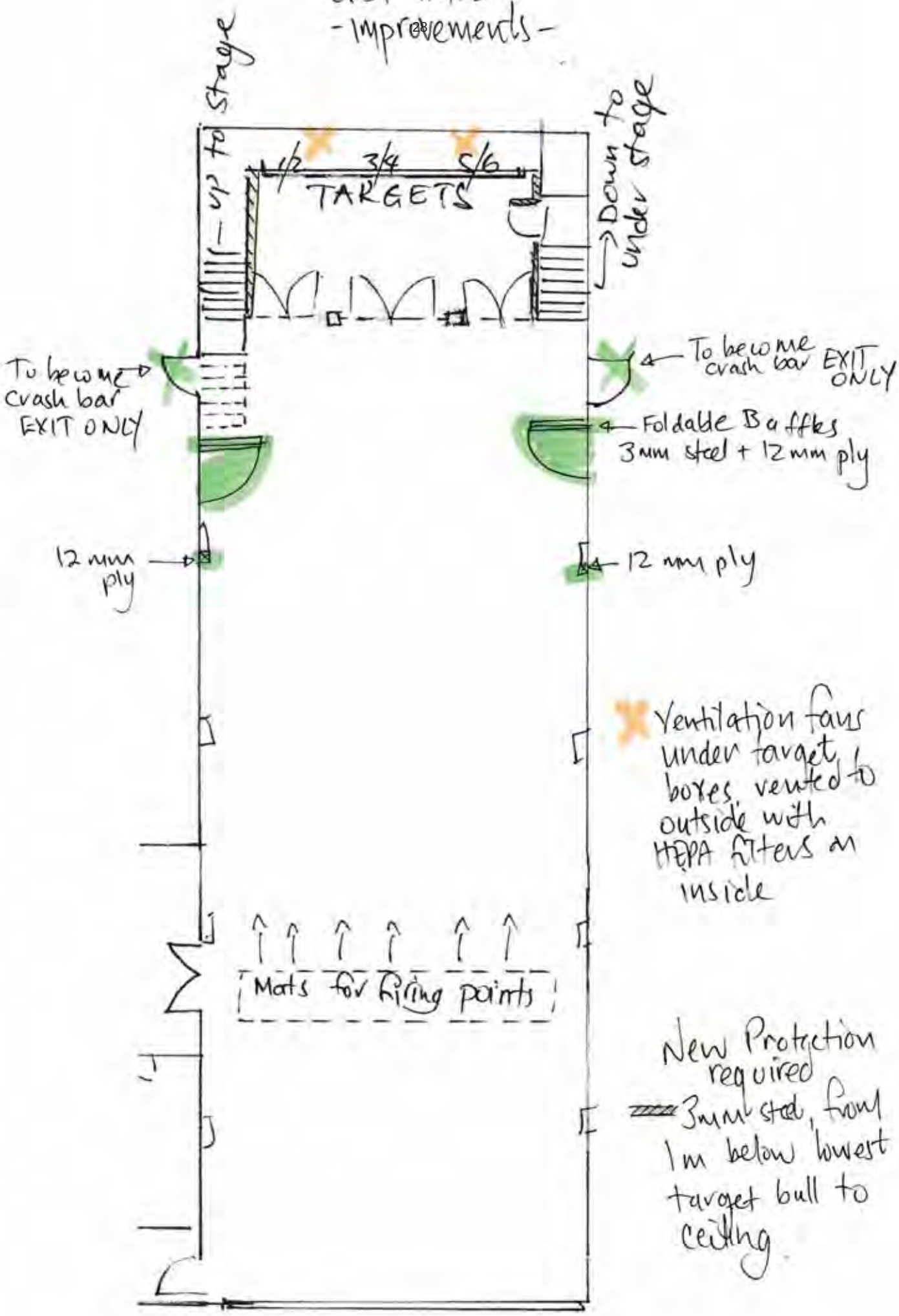
Ventilation fans to be added to target area – preferably 2, one each side. To be placed under the wooden target frame boxes, vented to the outside, HEPA filters on the inside.



CUST
COMMUNITY
HALL

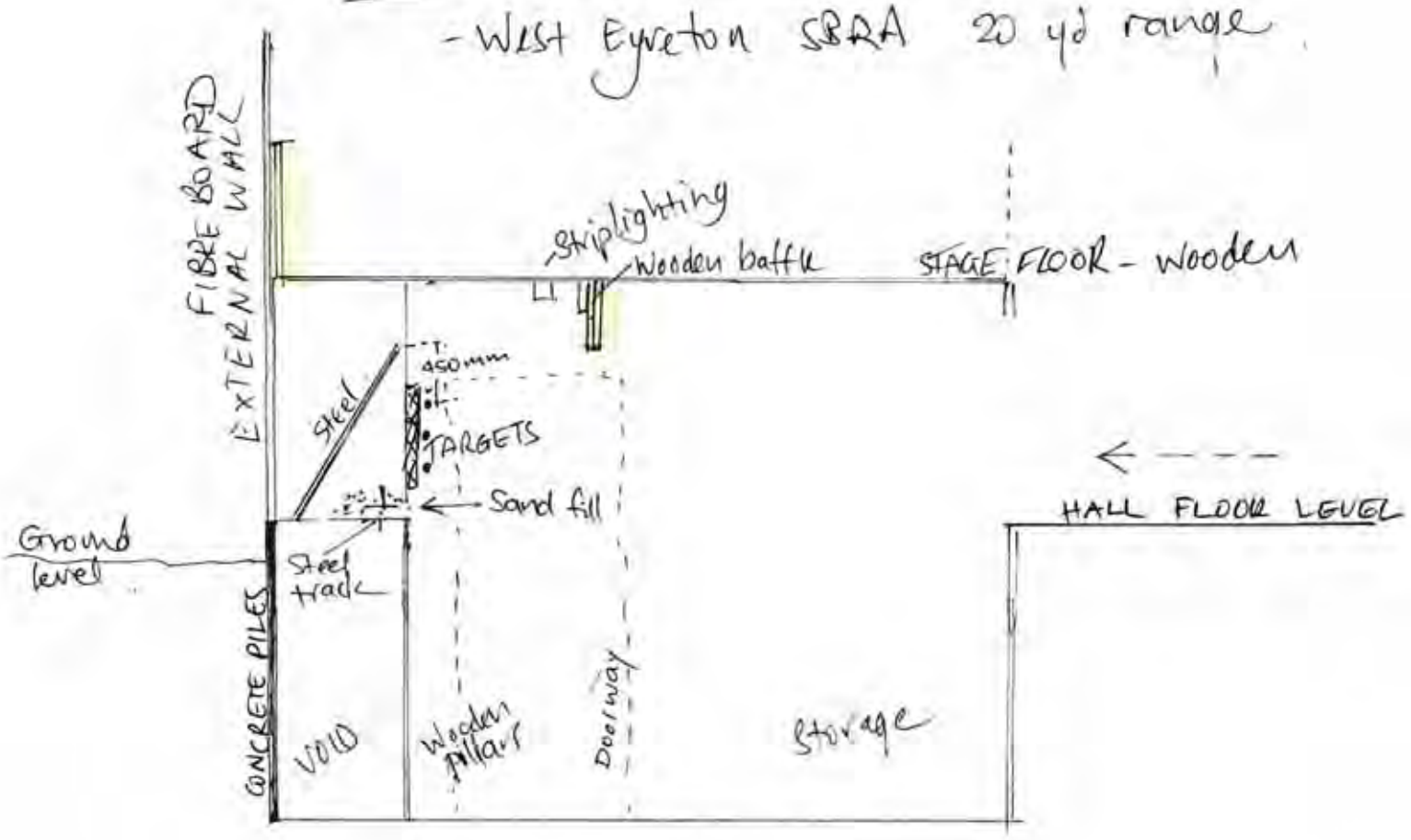
- Used by West Eyreton SB club
  - 20 yd range.
  - targets under stage.
  - 6 mounds

CUST HALL
- Improvements -



CUST COMMUNITY HALL

- West Eyeton SBRA 20 yd range



1. Extend baffle in front of strip light lower to just above door – 4mm steel faced with 15mm ply. To be across entire width of target boards, no gaps apart from at joists.

2. Exterior wall protection – placed on inside – 1.2m height, 3mm steel faced with 9mm ply.

Target Shooting New Zealand

Target Shooting Range Manual

For Rimfire and Air Rifle Shooting

Author: Ross Mason

Off the Wall Assistance: Rick O'Shea

Published by TSNZ: October 2019

Authors:

Ross Mason:

A smallbore shooter since 1971, has represented Hutt Valley, North Island Indoor and 50m, New Zealand Slazenger, Dewar, Home Counties, Oceania and Commonwealth Championships. NZCS in Applied Physics (1975). Employed 13 years at Physics and Engineering Laboratory, DSIR, and Division of Information Technology. Retired after 20 years from Humidity Standards, Measurement Standards Laboratory. Qualified as Range Inspection Officer 1996. Interests include the Physics of Target Shooting, Vision in Target Shooting, Wind effects on shooting, Range Lighting, designing Target Changers, NRANZ Chairman and NRANZ Range Inspector.

Rick O'Shea:

A small boring shooter from Waikikamukau. Qualified as a Bar Inspector in 1909 and 7th Dan Bouncer in 1962. Has an invigorating propensity for stupendously enlarging vocabulatory requirements with gross circumlocutions especially when he has nothing to say. He is a barrel of fun but is frequently referred to as "a loose cannon". He has a fragmented lifestyle and a marked tendency to go off at a tangent. He cracks under pressure and immediately goes to pieces. He started life straight and true but in his wild youth regularly did time breaking rocks. Frequently gets high as a kite but eventually comes back to earth. He is easily wound up and ends most parties bouncing off the wall. He demonstrates a short attention span by the fact he suddenly digresses from what he was aiming at the most inappropriate moment. Nearly as fast as a speeding bullet he can travel quicker than the eye can see, whizzes over 10 story buildings and exhibits an extraordinary ability to dent egos in an instant. He is remarkable at reaching the most outrageous and unbelievable nooks and crannies. Regular shots are required to in order to control his tendency to spread highly contagious diseases. This a losing battle judging by the pock marks left with his intimate contacts. Regularly heard as a well-paid extra in cheap westerns but has repeatedly been found difficult to work with. Whines a lot.

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Introduction

Smallbore Target Shooting in New Zealand has a history extending back to the turn of the 20th century. The pursuit was generally followed by people who wanted to practise target shooting locally without the need to wait for fine weather. Local community halls and purpose-built indoor ranges were put into use and the practice quickly turned into a recreational sport.

Later, with the sport becoming an Olympic and Commonwealth Games events, 10m air rifle and 50m smallbore rifle ranges were constructed.

There is a need to develop a document outlining the safe utilisation of Smallbore Rifle Ranges. This comes about with Government Departments and Local Bodies demanding that pursuits such as target shooting are carried out safely and without annoyance to the general public.

TSNZ's number one priority in this Manual is to ensure that Smallbore Rifle Shooting continues to be a safe Recreational Sport. It endeavours to provide Smallbore Target Shooting Clubs with information so they may upgrade existing ranges to acceptable safety standards and to provide a resource for planners of Smallbore Rifle Ranges in the future.

It does not propose to be a Gospel for Shooting Ranges - especially in the detail. There will always be the opportunity for the use of any other form of procedure, protection, device or material not specifically mentioned in the technical details of this manual to be used in the construction of ranges. The only criteria required is that any procedure, device, design or technical change must be documented and demonstrated that it fulfils its design function to the satisfaction of TSNZ .

Standards

There is a general lack of information and standards on the construction of Shooting Ranges. Most of the information available has been written by the military.

JSP403 is the Joint Services Publication overall catalogue number for a host of Range Manuals for UK Military ranges. These are available here:

https://www.gov.uk/government/publications/jsp-403-volume-2

JSP403 has been the information reference used by UK NSRA and other shooting organisation in New Zealand including NZ Pistol Association and National Rifle Association of NZ.

This has enabled NZ shooting organisations to rewrite their manuals with up to date information.

Further sources are continually being assessed and any relevant and potentially useful information that is backed up by reference to accepted international publications will be incorporated in this manual as supplements. The New Zealand Police have produced their Range Manual that Pistol NZ use as their reference document.

These references have been used in the past as de facto standards within New Zealand Shooting Organisations.

This author is of the opinion that any of these documents alone are insufficient to use as a total reference when implementing changes to existing ranges or the design of new ones. Therefore this manual has extracted sections, drawings, construction and design criteria from any that are relevant to Rimfire and Air Rifle Shooting.

Aspects of the application of JSP403 have been used to certify Allen Range (Trentham 50m) for civilian target shooting that appear to contradict accepted practice as outlined in JSP403 in applying military shooting standards to civilian usage of ranges. This is totally due to the military accepting the fact civilian target shooting is significantly more accurate than normal military shooting training activities.

The outcome is significant for 50m outdoor ranges where the calculated Cone of Fire (COF) for smallbore rifle has enabled a considerable reduction in the footprint for a 50m range.

In all other cases, e.g. Indoor 20 and 25yd ranges, more conservative recommendations will generally be the criteria adopted. These types of ranges are the learning venues for practically all smallbore shooters. The provision of enhanced safety is required because of the higher rate of “random shots”.

▶ This sign indicates a paragraph containing important criteria, instructions or recommendations TSNZ deem all Ranges shall comply with.

The reasoning for these requirements is to ensure shooting is carried out safely. A proportion of the safe operation is related to the ***physical range construction,*** a proportion is related to ***range use procedures*** and the rest is related to ***common sense***.

What this Manual is about

This Manual is designed to provide technical guidance along with typical examples of physical layout and equipment used on Rimfire and Air Rifle Ranges.

It is specifically related to smallbore (0.22in or 5.60mm calibre), subsonic, soft lead projectiles fired from a single shot target rifle and 0.177in or 4.5mm pellets fired from a single shot air rifle. To ensure clarification throughout this manual, from here on in, smallbore ammunition as described above, shall be referred to as “RIMFIRE” unless otherwise stated. Air Rifle projectiles will be referred to as “PELLETS”

The general specifications of Indoor 20/25 yd., Air Rifle and Outdoor Rimfire Rifle Ranges will be dealt with separately. Content will overlap and all endeavours will be made to ensure any differences are obvious.

Seven Basic Rules for Firearm Safety

1. **Treat every firearm as loaded**
2. **Always point firearms in a safe direction**
3. **Load a firearm only when ready to fire**
4. **Identify your target**
5. **Check your firing zone**
6. **Store firearms and ammunition safely**
7. **Avoid alcohol or drugs when handling firearms**

New Zealand Arms Code

Safety is Paramount

All shooters in TSNZ affiliated ranges shall:

- Be familiar with the Range Operation Manual (Range Safety Orders)
- Be familiar with the safe use of firearms
- Use all firearms under the controlling instructions of the Range Officer.
- Obey the designated Range Officer who shall have absolute control of the rifle range while shooting is in progress. Shooters shall obey ALL their instructions.
- Treat firearms AT ALL TIMES as loaded. This means when handling any firearm, check the action is open and the breech is clear of ammunition, and an empty chamber flag inserted.
- Ensure that visitors to TSNZ affiliated ranges shall be accompanied by a person competent in the safe handling of firearms and who is fully conversant with the Range Operation Manual. This person shall ensure that a valid firearms license holder is present whenever a visitor is handling a firearm and that before the visitor handles a firearm they are informed of all safety procedures pertaining to the Rifle Range and the safe operation of firearms.
- Ensure that AT ALL TIMES the Rifle Range shall be operated in a manner that ensures the safety of all shooters and the general public.

***Firing Range Safety Implies**:*

- the proper use of a range as it relates to its physical design;
- a continuous and ongoing training programme for users, instructors and Range Officers;
- regulations on the safe use of the range coupled with enforcement of these regulations are followed.

Range Construction

- All Rimfire and Air Rifle Ranges shall be constructed to ensure projectiles fired from the firing point towards the range targets are confined within the immediate range area and their remains do not pose a hazard to safety and health.

Indoor: This means within the building

Outdoor: This means within the area defined by the appropriate range design.

The physical range construction is designed to prevent the remains of bullets, - whether they be whole or in part, from exiting the building or range environs, or returning to the shooter as dangerous projectiles.

The construction will be designed to capture the bullet or to deflect the bullet so that it may be captured and to enable ricochet - if and when it occurs - to occur safely.

No Danger Area Ranges

In general a "**No Danger Area**" range is created by the introduction of a stopbutt or wall, either of natural or artificial composition, used in conjunction with a severely restricted arc of fire.

A range that does not conform to the "No Danger Area" criteria must therefore be tested as a "**Full Danger Area**" range using the "**Safety Template**" applicable to the firearm and ammunition that will be used on the particular range.

- All new 10m, 20 and 25yd Indoor, and 50m Outdoor Ranges on which TSNZ affiliated Clubs and/or Associations hold TSNZ sanctioned events shall conform to the "No Danger Area" range criteria.

Danger Zone Definitions

There are three main Danger Areas within a range that require protection from direct and indirect bullet strikes.

Defence Zone

Areas subject to occasional impact that will usually strike at shallow angles. Side walls, roofs, floor.

Backplate area

Areas subject to more than occasional direct strikes

Bullet catcher

Areas subject to intense and continual strikes. Immediately behind the targets - and including the warmer or fouling shot area!

Indoor Ranges

The criteria are based on the angles and distances as outlined in Table 1, Appendix 1 and the minimum construction details outlined in “Danger Area Protection”.

- The range shall be constructed or modified such that it is able to meet or exceed the criteria.

Table 1 - Indoor Range Defence Zones

Defence Zone	Description	20yd	25yd
Vertical	Limit of **Defence Zone** over LOS to highest target centre	2.2 m	2.8 m
Horizontal	Limit of **Defence Zone** from flank LOS	1.3 m	1.6 m
Backplate			
Vertical	**Backplate** height over highest LOS	700 mm over LOS	700 mm over LOS
Horizontal	**Backplate** width beyond flank LOS	450 mm per flank	450 mm per flank
Bullet Catcher			
Vertical	**Bullet Catcher** height over highest LOS	150 mm over/under LOS	170 mm over/under LOS
Horizontal	**Bullet Catcher** width beyond flank LOS	150 mm per flank	170 mm per flank

See:
https://www.gov.uk/government/publications/jsp-403-volume-2 Table 6, Page 30

Note: The LOS (Line of Sight) is defined as the line from the rifle barrel (measured from 300mm directly above the firing line) to the target. These design heights and widths are at the target line. Backplates and bullet catchers can be at differing distances behind the target. To cater for this, the height and width of the bullet catcher and backplate shall increase at a rate of 20 mm per metre behind the target. i.e. If a backplate is 1.5 m behind the target line, the dimensions of the backplate will increase by 30mm in both height and width.

Explanation: For 25 yd. range. The bullet catcher shall extend to the side from the furthermost target by 170 mm. This means the extreme left or right hand counters on a 10 or 11 bull target. Likewise the bullet catcher must extend 170 mm above the top counter and below the bottom counter of a 10 or 11 bull target.
[And remember a 20 shot card is wider!]

Finding the Defence Zone for Indoor Ranges

This is measured 2.8 m at the target line while the rifle is aiming at the TOP ROW of counters. Likewise 1.6 m to the left and right of the extreme firing positions from the edge most counters. Where these lines intersect the roof and walls of the range defines the area that encloses the total Danger Area. TSNZ will adopt a rifle height of 300mm above the firing point for measuring purposes. Left and right handed shooters are to be taken into account in this measurement.

The defence zone relies on the application of the TSNZ range practice rule that instructs all shooters to ensure that a rifle is finally cocked* on the shoulder and pointing towards the target.

[* The closing of the block of a Martini action or the final firing spring tensioning action of a bolt action. On an Anschutz bolt action this is the rotational movement of the bolt once it has been closed.]

Vertical Defence Zone Conversion Calculations:

For ease of calculation, for 25 yd. range, is 120 mm for every metre i.e. 1 metre from the firing point the safety angle line is 120 mm away from the LOS. For 20 yd. range it is 100 mm for every metre behind the target line.

Danger Area Protection - Indoor

The protection requirements for the three zones are as follows:

Defence Zone

Since this area will generally be subject to occasional impact, the requirement is to contain bullets that glance the walls, floor and ceiling at shallow angles. The provision of vertical baffles along the wall if there is sufficient space and their incorporation in the ceiling may be advantageous in allowing a minimum of material to be used. (See Baffles below)

Acceptable surfaces for the Defence Zone:

- Smooth concrete floor.
- Soft earth floor or pea gravel.
- Concrete block walls, smooth finish with smooth pointed joints.
- 3mm sheet steel supported on the walls and ceiling overlapped with the join towards the target.
- Adequate thickness of overlapping timbers.

30mm Hardwood 40mm Softwood	Extremely variable depending on type and quality of timber

- Double thickness 16mm Particle Board (MDF)
- Any other method ***demonstrated and documented*** to be equally as effective

Pillars

Concrete or steel pillar supports that project into the range along the walls or down the middle of the range, shall have their facing sides (face nearest shooter) protected with soft timber. This prevents backsplash and the 'reflection' of shots back to the shooter.

Suitable cover is 50mm soft wood attached firmly to the pillar.

See Appendix 3 and 7 for further detailed examples.

Backplate

This area is subjected to more than random shots and will usually be hit with a direct shot at steep angles. Since there is not sustained damage in a concentrated area, the surface need only stop no more than 2 or 3 bullets in any one spot.

Acceptable surfaces for the Backplate:

- Smooth Concrete blocks covered with 25mm of softwood
- 4mm sheet steel covered with 25mm of softwood
- Any other method ***demonstrated and documented*** to be equally as effective

Bullet Catcher

This area will be subjected to sustained impact in a concentrated area. It requires special construction to ensure the capture of the bullet.

A number of devices have been developed that are suitable for this requirement.

- Sand supported by timber boxing
- Sheet steel deflectors
- Wooden blocks (Temporary ranges only)
- Bullet traps that contain the bullet and fragments within itself
- Proprietary supplied bullet catchers

See Appendix 5 and 7 for details of a number of examples.

Points to note:

- This bullet catcher is the greatest generator of lead dust. The smashing of the bullet into and through bullet catching material scrapes off significant quantities of lead particles. The best types of bullet catchers are those that are easily maintained and require the minimum of protective equipment to clean. i.e., produce a minimum of lead dust.
- The cleaning and maintaining of bullet catchers and the rifle range in general is outlined in *Lead - Recommended Clean-up Procedures* on Page 30.

Ceiling Protection

The case of ceiling protection can be approached in a variety of ways. The priority is to prevent direct shots and ricochets from exiting the range. The ceiling invariably is the 'weakest wall' of a range. Ranges that are built beneath buildings have a requirement to prevent shots going through the floor into the spaces above. Corrugated iron sheet by itself is not adequate as protection for direct shots.

The methods outlined in the Danger Zone requirements are effective but sometimes space requirements and cost may mean that other methods are more useful. So much depends on the layout of the range but the function of the installed protection shall remain.

Ranges with a reasonably high ceiling and width will almost certainly have rafters and/or trusses supporting the roof. These vertical sections can be utilised to support bullet catching material that will prevent the direct shot from exiting the range. Remember that in this case the vertical truss is no longer taking glancing hits, it will therefore require more protection than the Danger Zone criteria. These vertical trusses are effectively baffles. The layout, use and design of baffles is outlined later.

Ranges built beneath buildings can utilise the floor joists (if they are running at right angles to the LOS) as bullet stoppers, or joists can be used to support protected sheet steel as per the Danger Zone criteria above.

- Remember that the addition of steel and other heavy material to the underside of floors, ceilings etc. may require engineering calculations due to the extra load on these structures. Check local Building Regulations before construction!

Baffles

Baffles may be placed in the ceiling or along the walls enabling smaller and possibly cheaper alternatives to protecting the full Danger Zone of the range.

The placement of the baffles is a matter of geometry. The basic idea is to place vertical or horizontal panels such that no direct paths are created for a direct shot to exit the range. They must be constructed such that the direct shot is stopped and ricochet and backsplash is eliminated.

If there is space to the side of the range and sufficient height then there may be a case for the installation of baffles instead of a full wall lining for the length of the safety zone. Remember that joists of a floor if they are running at right angles in effect are baffles. Generally if the walls are close to the LOS then a sheet type of protection on the wall is the most feasible. Baffles should also be used to protect light fittings along the range.

It is important to note that if there is a chance of ricochet from within the range such that a ricochet bullet is likely to hit the ceiling between the baffles, then it is necessary to ensure that the ceiling itself can stop the ricochet. The bullet loses significant energy after a ricochet and therefore the ceiling may only require a minimum of protection. A lining of 12mm particle board, 10mm ply, or equivalent would be appropriate.

See Appendix 3 and 7 for construction and placement detailed examples.

Firing Points – Indoor Ranges

TSNZ recommends that 1.25 m be allocated to each Firing Point. This will ensure left handers should be able to be accommodated anywhere on the mound. The mound should be built flat.

Indoor Range Access During Shooting

It is necessary to ensure that access to the range in front of the firing points and within the range safety area is eliminated while shooting is in progress.

- Target changing doors need to have some form of lock and emergency exit doors need to be only accessible from inside the range. Electric interlocks on target changing doors that operate with any ‘red light’ system may be utilised but must be regularly checked for correct operation.
- It is important that any locking mechanism must be able to be overridden to ensure easy exit from the range in an emergency. Do not forget to ensure that the overriding instructions are well known – paradoxically even to those you are trying to keep out!

Temporary Ranges

There will be occasions when shooting is carried out on temporary premises, e.g. Town halls, gymnasiums. In these cases it is imperative to ensure that all external doors and windows behind the target area, e.g. supper rooms, toilets, are locked and / or entry restricted while shooting is in progress.

▶ Entry points on the outside walls of the building accessible to the general public that may enable them to enter the area in front of the firing line and within the safety areas must not be accessible from the outside.

The stringent requirements for permanent Indoor Ranges can be acceptably modified for temporary ranges. The strict criteria that shall be applied is that the rear wall to the outside of the building shall not allow a direct shot from exiting the building

outside of a reduced Danger Zone. It is accepted that competitors using the temporary range will be sufficiently skilled in correct procedures to enable the full Danger Zone criteria not being applied. Carefully positioned bullet stops can be installed. Wool or Rag bales can fulfil the requirements of a reduced “Danger Zone”.

Timber block bullet catchers that measure at least 100 mm outside the target area and at least 300 mm in depth can be used in temporary ranges. The number of shots fired during such events will be insufficient to compromise the timber.

It is recommended that the area in front of the firing point be covered with wide brown paper. This should extend to at least 8m from the rifle muzzle. The overlaps should be taped. At the conclusion of the match the paper should be carefully rolled up and disposed of. This will ensure minimal vacuuming needs to be done and ensures the opportunity for lead dust and powder residue collection is maximised.

50m Outdoor Range

The application of the Cone of Fire (COF) criteria as outlined in JSP403 has significantly altered the acceptable range safety specifications for smallbore rifle on 50 m ranges.

Statistical tests have been carried out to determine the raw COF for 50 m smallbore rifle shooting. This includes positional shooting and the following COF has been calculated and will apply until any future tests show otherwise.

Smallbore Rifle COF **5 standard deviations = 120 mm Diameter**

Statistically this implies that approximately 1 in 1million shots is expected to hit outside a radius of 60mm centred on the middle of the target for a shot aimed at the target.

Of course, it is known that shots occur outside this circle on more frequent occasions. Therefore, there is a requirement to estimate where these shots are likely to appear. This can include the following: those shots that are deliberately aimed at the wrong target, these usually occur within 2 targets of the intended target; Accidentally discharged shots occurring when the bolt is closed and a shot goes off; A shot inadvertently let off in the process of aligning the rifle on the target.

Extended COF for Smallbore Rifle Target Shooting

Raw COF	=	0.06m
Azimuth COF (2 targets)	=	2.5m
Estimate of “loose shots”	=	0.5m
Therefore the total COF is	=	0.5m vertically (elevation) 2.5m sideways (azimuth)

The sideways COF is defined as a shot being fired from 2 firing points from the end and hitting the end targets. This will define the width of the bullet catcher required.

A similar procedure to the Indoor Range is used to ascertain whether a range meets the “No Danger Area” criteria for Outdoor Ranges.

A set of Safety Angles, StopButt and Bullet Catcher Wall widths and heights are set out in Table 2 and Appendix 2. The only difference is that the measurements are scaled up to the required ranges, which in Smallbore Rifle shooting is usually 50m.

The criteria for a “No Danger Area” range includes a “***severely restricted arc of fire***” and by insisting that the firearm is cocked at the shoulder, the design of this type of range fulfils the criteria adequately.

- A Range to qualify as a No Danger Area Range shall be constructed or modified such that it is able to meet or exceed the criteria.

Table 2 – No Danger Area Outdoor Range Defence Zones

Stopbutt	**Description**	**50m**	**100m**
Vertical (C in Appendix 2)	**Stopbutt** crest over LOS	3.5 m over LOS	4.5 m over LOS
Horizontal (XY in Appendix 2)	**Stopbutt** flank width	2.5 m per flank	4.0 m per flank
Bullet Catcher			
Vertical	**Bullet Catcher** height over highest LOS	0.850 m over LOS	1.0 m over LOS
Horizontal	**Bullet Catcher** width beyond flank LOS	0.6 m per flank	0.75 m per Flank
Crest of Stopbutt	Thickness at top of stopbutt	0.6 m	0.6 m

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Note:

1. The LOS (Line of Sight) is defined as the line from the rifle barrel (measured 300mm immediately above the firing line) to the target.
2. These design heights and widths are at the **target line**. Stopbutts and Bullet Catchers can be at differing distances behind the target. To cater for this the

height and width of the stopbutt and Bullet Catcher shall increase at a rate of 20mm per metre behind the target. i.e. If a Bullet Catcher is 3m behind the target line, the dimensions of the Bullet Catcher will increase by 60mm in height and 120mm in width.

3. The top of the Bullet Catcher and stopbutt may be further back than the bottom of the Bullet Catcher and stopbutt. This must be taken into account. i.e. The top of the stopbutt crest will be wider by the proportioned amount.
4. Given that the target is in the same position for all 3 positions in 3P shooting, The prone position is the 'worst case' for calculating the stopbutt height. When kneeling and standing the LOS is depressed relative to the prone position.
5. The same rules for multiple targets as indoor apply for outdoor ranges. i.e. the top row counters and the furthermost counters are taken into account for calculating LOS.
6. The Range Danger Area for this "No Danger Area" range is a 100m circle at each end of the stopbutt where the LOS of both vertical and horizontal converge on the stopbutt. This covers the possibility of "pop overs" occurring from the stopbutt or bullet catcher.

Explanation

Table 2 above is based on the premise that "normal military training" is being carried out on this type of range.

An important qualification that was introduced for the Allen Range, Trentham was the range operational procedure that smallbore shooters must be trained on a 25 yd. Indoor range before shooting on the Allen Range. This was to show the shooter was demonstrably able to shoot within the COF applied to the Allen Range for smallbore rifle shooting.

This procedure enabled a substantially reduced bullet catcher / stopbutt height. This was reduced to 1.5m above the target height (measured at the target line).

The possibility to use such a reduced COF is contingent on the above restriction on the use of the range by "experienced shooters".

If this is instigated then this criterion must be included in the Range Operation Manual.

The existence of an extensive stopbutt behind the range had a substantial effect on the acceptance of this procedure and construction. The case was made that the existing bullet catcher required for pistol shooting was more than sufficient to enhance the NDA range criteria for smallbore rifle shooting.

- A Range to qualify as a No Danger Area Range shall be constructed or modified such that it is able to meet or exceed the criteria.

Application of Field Firing Area Templates

A Field Firing (FFA) template is used when the criteria for a 'No Danger Area' range is unable to be fulfilled on an outdoor range. It outlines the area that a bullet may be expected to pose a danger if shooting is carried out within the confines of a range and directed towards defined targets. In TSNZ's case this usually means a 50m range firing towards targets where bullet catchers may or may not be being used.

The COF for smallbore will almost certainly mean that the bullet impact area ***behind*** the target is the important area to concentrate on.

- All new ranges must fulfil the requirements of a 'No Danger Area' Range.
- All existing ranges that do not comply with the 'No Danger Area' criteria shall have the FFA template applied.

Figure 1 page 21 indicates the shape and dimensions of a FFA.

Point FP is the firing point. The distance that the FFA extends will be 1200 m from point FP. The width of the FFA is related to the type of area that is between the shooter and the targets. 150 m is applicable with soft or ground targets. 300 m is applicable for hard or rocky targets. That is, if there is soil and grass up to the targets then it is soft, If there is a considerable number of rocks or hard areas up to the targets then it is hard.

The FFA is transferred to a clear plastic overlay and manufactured to the same scale as the map that it is to be laid over. Small holes drilled accurately at the corner points make transferring the FFA to the map easier. A sharp compass needle works well.

It is necessary to take into account the width of the firing point. This means that the extreme firing points are used to find the total area that the FFA will apply to.

How to apply the FFA template

1. Obtain a map of suitable scale. At least 1:50,000. Larger scales of 1:20,000 or 1:10,000 would be better. It is imperative that it be based on a surveyed base grid. LINZ sourced maps comply with this requirement. It must have a geodetic scale over the map.
2. Identify the position of the range, firing line, target direction and target line. This should be done with a compass to get the proper directional alignment. Taking into account the Magnetic Declination, convert the directions from Magnetic to True.
3. Measure the length of the firing line with an accurate tape measure.

4. Identify one end of the firing line and transfer the length and direction of the firing line to the map.
5. Construct lines from the ends of the firing line towards the targets. This is assumed to be at right angle to the firing line.
6. Place point FP over one end of the firing line, align the centre line of the FFA over the target direction line and carefully mark all corners of the FFA onto the map.
7. Repeat this with the other end of the firing line.
8. There will now be two FFA's overlaid onto the map. The complete area that both FFA's cover is the area that needs to be taken into account when defining the safety zone.
9. Identify any features where people, animals and building may be within the safety zone.
10. If there are any features that relate to this within the Safety Zone then measures must be taken to eliminate and / or minimise the problem.

Figure 2 shows an example of a FFA overlaid onto a map.

▶ TSNZ requires that any range where a FFA template is applied must have a Safety Zone that can be ensured to be free of persons occupying houses, roads, walkways, that are legitimately accessible to the general public if shooting is active. Permission must be obtained from the land owner/manager to enable application of the FFA. There is a responsibility of the range operator to inform the land owner/manager of the seasons shooting programme. It is imperative that communication between the Range Users and the Land Users be initiated detailing when shooting is to take place.

Using Google Earth

Google Earth has the ability to display contours and distances. The distance ruler is accessed via the menus at the top of the page. It is an easier process than finding paper maps. As the satellite images are updated regularly the latest improvements around the range are easily identified.

Coordinates of the range can be read off the page.

Figure 1

Full Field Firing Template

Rimfire subsonic 0.22 calibre

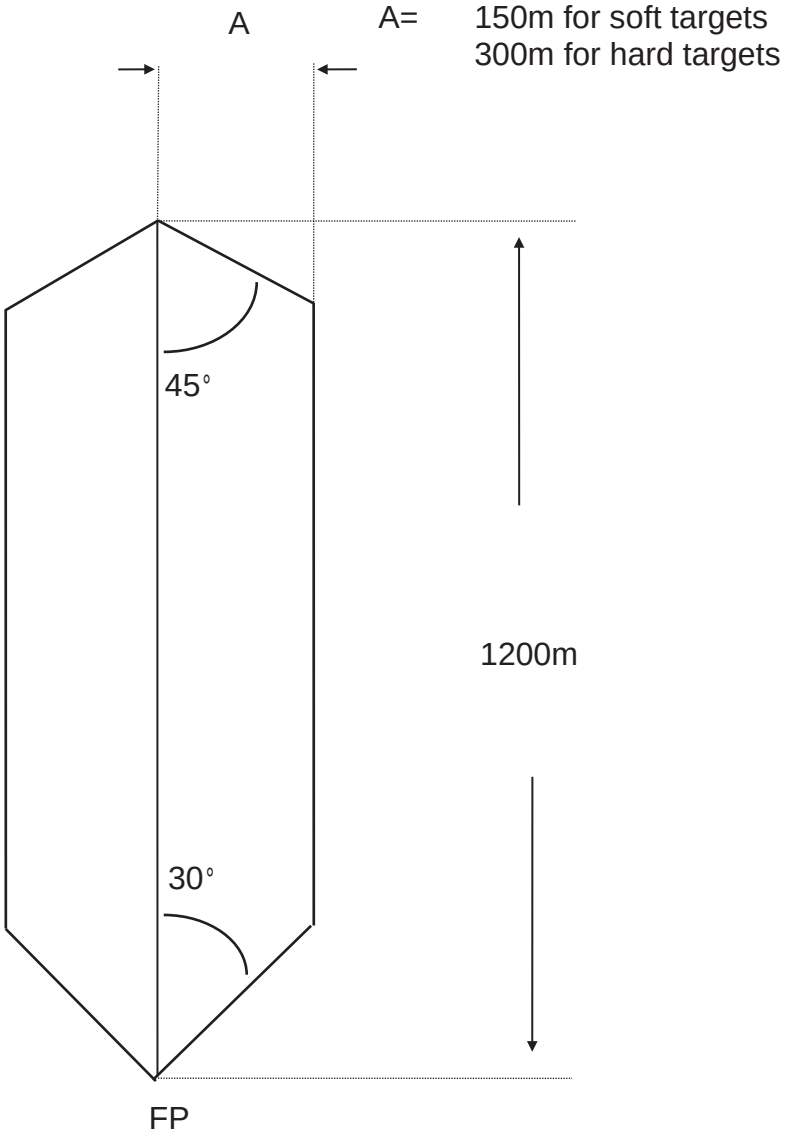
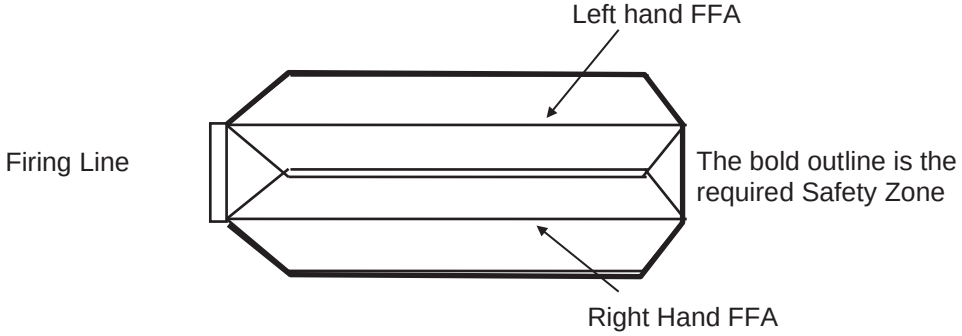


Figure 2

Applying FFA to Range



Ricochet

It is useful to discuss ricochet and when it is likely to occur. The stopbutt criteria imply that the surface of the bullet catcher and stopbutt is a “penetrable” target. A bullet will rarely ricochet when the impact angle is greater than 30° from the surface of a penetrable surface. It is obvious then that since the stopbutt angle must be greater than 56°, a direct hit will strike at an angle greater than 30° over the whole of the stopbutt. That is, it will rarely induce a ricochet. A direct shot in practically all cases is absorbed by a conforming stopbutt. If the angle of the stopbutt is less than 56° then it is possible that a direct hit will hit at an angle less than 30° thus increasing the danger of ricochet. A further case for a conforming stopbutt is to ensure that ricochet occurring from the ground between the shooter and target will have a good chance of being caught by the stopbutt.

Stopbutt

The adequacy of a stopbutt has been fraught with one big problem. The problem has always been the interpretation of the requirements. The two types, natural and artificial are subject to stringent criteria. To understand the reasons for adequate stopbutts it is necessary to understand the ricochet danger.

Natural Stopbutt

Usually consist of natural hills, quarries, sandpits, old mines etc. But rarely is a natural hill adequate for the purpose.

The natural stopbutt must conform to the following:

1. Must be the highest available bank face
2. A downrange area, beyond the bank face, comparatively free from habitation, roads, and pathways.
3. A forward area (this means between shooter and target) and bank as free as possible from hard, ricochet inducing surfaces consistent with 1 and 2 above
4. A bank slope not less than (56°) or a slope of 3 in 2 (3 units up for 2 units along) from the horizontal (over the total mean height).

No. 4 is the hardest to acquire and harder to accept as necessary. It is steep!
It comes down to the function of the stopbutt, which is to stop a direct shot and a ricochet from any part of the ground between shooter and target.

Note the exception if the Bullet Catcher extends to the full stopbutt height below.

Artificial Stopbutt

Usually consists of earthworks specifically designed to conform to the stopbutt criteria. Points to note here are the height and width of the stopbutt and the thickness of the top of the butt.

- For rimfire ammunition this minimum thickness of the crest is 600mm.

- The minimum slope of a stopbutt is 3 in 2. That is, for every 2 units horizontally the height increases by 3 units. This is equal to 56°. This angle is measured from the base of the slope to the top of the crest. See Appendix 2

- The stopbutt shall consist of material that is penetrable. (i.e. Clay or material such that a bullet impacting the bank will be retained).

Bullet Catchers

A form of bullet catcher must be provided over the full width and height as defined in Table 2. It may consist of timber, dense rubber screens, sand or fine soil, free from hard lumps and stones. Alternatively proprietary steel bullet traps with baffles may be used provided all risk of splash back to shooters, arising from such devices, is eliminated.

In naturally occurring stopbutt / walls, the bank itself may consist of sand or other light grained material, which is itself suitable as a bullet catcher. The angle from the horizontal of this sand bank type of bullet catcher shall be kept greater than 34° (A slope of 2 units up and 3 units along). However, due to de-leading, constant firing and weathering, the lower portions will eventually collapse and seek a natural angle of repose of less than 30° to the horizontal, thereby rendering the bank unsuitable.

- Regular maintenance needs to be carried out to ensure the correct slope is maintained.

Ricochet will rarely occur with bullets hitting ***soft sand*** at angles greater than 30° from the horizontal. Note here the mention of ***soft sand***. The criteria for the rest of the stopbutt being a penetrable target implies that it may be clay or similar penetrable material.

The slope of the bullet catcher must be kept at an angle of greater than 34° or a slope of 2 in 3 at all times. (i.e. 2 units up for 3 units along the ground) This ensures that the bullet will have less tendency to ricochet from the catcher.

It is advisable to build up a bullet catcher separate from the stopbutt. This will keep the stopbutt wall in one piece and will allow easier maintenance of the bullet catcher, for instance de-leading the catcher. Removing spent bullets helps to eliminate the occurrence of ‘pop-overs’. Pop-overs are when a live round hits a spent round and ejects that out of the bullet catcher. These have the potential to be propelled with reasonably dangerous velocities anywhere over the stopbutt. Regular sieving of the bullet catcher keeps this to a minimum. Building up the front edge of the catcher will

enable the thickness of the sand trap to be retained easier. The thickness of the bullet catcher must not be less than 600mm, measured horizontally, at any place within the bullet catcher measurement criteria.

- Other bullet catchers consisting of timber walling of sufficient thickness to absorb all shot and eliminating backsplash, or thinner timber that allows the shot to pass through into a protected clear space behind can be utilised. Both of these require regular turning and moving of the timbers to ensure that they are not "shot out" and lose their effectiveness.
- It is recommended to install stakes indicating the required angles along the stopbutt and bullet catcher to indicate slope disintegration. This enables easier maintaining of the slopes as well.

Note: If a Bullet Catcher extends to the full height of the required stopbutt, the steep stopbutt is not required.

The Firing Point to Target Area

The area of ground between the firing point and the target should be clear of all ricochet inducing material. This includes rocks and stones to less than 10mm diameter. Sticks and hard clods of clay should also be removed. It should be of a "soft" target nature that will cause a minimum of ricochet of any shot accidentally fired into it. Top soil covered in mown grass is the ideal. But any soft shot absorbing material will suffice. Literature suggests that any ricochet from a shot hitting the ground (of soft soil) between shooter and target will tend to be deflected into the area of the stopbutt.

For smallbore rifle shooting the ground will be outside of the COF. It is advised that the ground should still be cleared of material likely to induce ricochet.

Range Accessories and Equipment

Any accessory and equipment that is used on the range must be of a material or protected material so that ricochet is prevented.

These must be constructed of material that will allow bullets to pass through relatively unimpeded and remain within the immediate range area. Or to catch a bullet and prevent ricochet.

Targets / Frames

Targets, their frames and target numbers should be made from wood or wood product or some other material that is easily penetrable by rimfire bullets. The centre of the target should ideally be 750mm above the mean ground level provided the datum point, 750mm below the target, is on the same horizontal plane as the firing point. ISSF specifications suggest that an allowance of ±500mm is allowed for the centre of the target from this 750mm height. That is, the target may be from 250mm

to 1250mm above the horizontal plane from the firing point. (Maidstone Changers have been shown to catch direct shot or reduce their energy to a safe level).

Flags

Flag sticks should be made from light wooden doweling or other material that will tend not to promote ricochet. The method of holding the flag to the stick needs to be of a light chain or thin gauge wire to ensure a small target is presented to a bullet. UIT specifications suggest the flag be made of cotton of a weight of 80gms/m^2 and be at least 300mm long and 50mm wide. There are no specifications as to how to hang it from the flag stick.

Targets at Intermediate Distances

It may be necessary to position targets carefully when the minimum stopbutt is being employed. The stopbutt must be designed for the greatest range used. This is especially true if a 100m range is used. When targets are positioned at intermediate distances e.g. 50m, they must be aligned so that they are echeloned, or on the same LOS as the 100m targets. In other words a shooter in the firing position will see targets in the same relative position when the targets are positioned at the intermediate and far positions. This ensures that the maximum use is being made of the stopbutt and that the range still conforms to a “No Danger Area” Range.
See Appendix 2 for an example of echeloned targets.

Check the bullet flight line for standing shooting when the targets are positioned at intermediate distances. The bullet needs to impact a bullet catcher. The range floor is NOT a bullet catcher!.

Firing Points

In the past, firing point space provided for each shooter has been a matter of squeezing in the greatest number of shooters as possible. This has meant that it has usually not provided a fair opportunity for all shooters to be offered the firing point of their choice or if drawn by lot, there has been a need to push left hand shooters to the end of the firing line.

ISSF specifications for target shooting stipulate a minimum distance between shooters and targets of 1.25m to a maximum of 1.6m. This allows for left and right hand shooters to fire on any firing point.

- TSNZ recommends that 1.25m be the minimum spacing between targets and firing points for any new ranges - Indoor or Outdoor. The firing point shall be flat for at least 2.5m from the firing line towards the rear of the firing point. It shall be constructed of hard material that will not shift or move from the influence of adjacent shooters or range personnel moving around behind the firing line. The provision of shooting tables from which to shoot may be an alternative to the floor of the firing point.

Regular Checking of Ranges

- A range must be regularly checked against the “No Danger Area” range criteria. Any aspect that does not conform to the criteria shall be rectified immediately before shooting can recommence.

A list of critical aspects of the Range should be made and inserted in the Range Operation Manual. A check against this list should be undertaken at the end of the season and about midway through the season. This will ensure maintenance is done prior to the next season and the midway check ensures the range is maintaining it’s integrity.

Air Rifle Ranges

Air Rifle Ranges are a case where the usual protection required for rimfire ammunition is not as stringent. Pellets have a relatively low energy and the range surrounds require significantly less protection.

Pellets propelled from an Air Rifle nevertheless can still be dangerous if a person is hit. The loss of an eye is extremely serious.

The same rules apply to Air Rifle shooting as rimfire shooting as regards the general operation of a range. Where Air Rifle Shooting differs is that sufficient protection is provided by general building materials and thus little special safety factors need to be built into any normal hall or room.

The major piece of protection required is a good pellet catcher. These usually come fitted to commercial target changing apparatus. Target changing equipment that is otherwise manufactured must have a pellet catcher. This needs to be 4mm steel set at an angle of at least 45° to the horizontal and 250mm square centred on the target position. A tray that catches and contains the pellet is advantageous.

The wall immediately behind the wall should be capable of stopping random pellet hits.

Lead dust is generated and care needs to be exercised when cleaning the range.

Range Hazards

The projectile emerging from a rifle is the prime hazard. Unburnt propellant from rifles is another, Lead requires safety in its monitoring and working with. Lead in damaged bullets collected in bullet catchers and lead dust on surfaces in the range and in the air are hazards that need special care. Hearing must be protected as the noise level from 0.22 Rimfire is sufficient to damage hearing.

Projectiles

It is clear that operational procedures outlining the use of a range ensures the safety of those using firearms, spectators and range workers. No one should be in front of the firing point under any circumstances while shooting is in progress.

Unburnt Propellant

Unburnt propellant is released into the range when a firearm is discharged. Long rifles will emit about 2% unburnt propellant. Pistols can emit around 7% due to their breech seals not being as efficient as rifles. Most unburnt propellant falls in the area in front of the firing point and distributed downrange. Temporary ranges and ranges with wooden floors show this distribution quite obviously. If it is allowed to accumulate it can pose a significant hazard. This is enhanced when it is gathered, swept or vacuumed into small volumes. Spent cartridges will also contain unburnt propellant.

Accumulated Dust containing Lead

Dust can contain lead. The blast from rifles can distribute the dust from the range floor and the shock waves can dislodge dust from walls and other surfaces. Dust collected during cleaning can pose an explosive hazard.

Noise

All persons within the firing point are required to wear hearing protection. Earplugs and commercial ear protectors are the methods for reducing noise and damage to the ears.

Access to the downrange area

Most ranges access targets from the firing point end. This entails walking through lead infested areas. The minimal movement down the range should be the norm within these ranges. Moving slowly and methodically ensures minimal disturbance of the lead from the floors. It is clear that footwear will transfer lead dust to the rest of the range. Measures should be put in place to minimise this transfer. The idea of a footwear transfer station is addressed later.

Lead

Lead and the human body

Lead is dangerous and can cause severe health problems. It can affect your blood, kidneys and nervous system including your brain.

Children are very susceptible to lead. A child is able to absorb upwards of 90% of ingested lead compared to about 10% for an adult. The effect of lead on children can be profound.

- No child under the age of 12 shall be permitted forward of the firing line or in the target area at any time.

Lead gets into the body by:

- Breathing in dust and fumes
- Eating or smoking with unwashed hands
- Biting dirty fingernails

Avoidance of Lead

Avoidance is the best policy in preventing personal lead contamination. This can be achieved by following some simple and basic procedures.

- Avoid eating and drinking within the confines of the shooting range.
- Avoid raising dust.
- Do not allow dust to collect around areas where people congregate.
- Do not sweep any part of the shooting range without wearing a mask. Avoid dry sweeping the range area.
- Wear overalls when cleaning and keep them separate from normal day to day clothing. It is necessary to wash these regularly. **WASH SEPARATELY**. **DO NOT INCLUDE THEM IN THE REGULAR WASHING OF DAY TO DAY CLOTHES.**
- Keep hands and fingernails clean. Hands should be washed in warm soapy water. Use a nailbrush. Wash the face before food is eaten or before smoking. Don't forget to wash before supper.
- Vacuum with efficiently HEPA filtered cleaners.
- Breathing through the nose decreases lead uptake.
- Avoid wiping hands across your face and mouth area.

Note: Clubs should seriously consider installing a hand washing basin in the social area of their ranges. This should have an instant hot/warm water supply. Club members should be actively encouraged to wash their hands before eating or drinking and before leaving for home.

Recommended Range Clean-up Procedure

▶ The recommended minimum clothing to be worn includes: overalls, gloves, footwear, breathing mask. The clothes should be carefully removed and washed separately from normal household washing.

Avoid moving rapidly. The clean-up should proceed slowly to avoid excessive dust movement.

Containers for the collection should be set aside. They should be easily handled. Lead is heavy. Many small containers are better than a few large ones.

Bullet catchers must be emptied slowly, a small shovelful at a time. Again to keep the airborne dust to a minimum.

Once the bigger pieces of lead, i.e. bullet pieces, are contained, it is then necessary to dampen down the area that contains the dust. A mist spray is best as it allows the smaller water droplets to be absorbed with the lead without dislodging it. Let the moisture soak and then wet sweep and / or wipe the accessible areas.

Care should be exercised in checking all places that lead can settle. Horizontal surfaces are the biggest collectors. Trusses, beams, wall top plates, floors are some places. To assist future cleaning it may be useful to line trusses with thin plywood so that the horizontal surfaces are no longer accessible to dust, thus leaving only vertical surfaces. Unpainted walls attract dust into the cracks. It is recommended that walls, especially timber, be painted.

Ventilation of Indoor Ranges

▶ The firing of lead bullets as used in Rimfire Rifles and Air Rifles contributes to airborne lead dust. To assist in preventing shooters from inhaling the gases produced by the firing process it is necessary to ensure there is adequate ventilation on the range.

It is necessary to ensure that an airflow towards the targets is present at all times. Ventilation exits at the target end of a range are necessary.

The provision of adequate ventilation is dependent on a number of factors:

- The range must be fairly airtight to begin with and must be maintained airtight.
- Existing bullet holes in roofs contribute to leakage. They must be sealed.
- This ensures that the maximum airflow will occur using air from within the range.
- If there are leaks, for instance along the top plate, ceiling and walls then air ingress will occur at those points.
- This means that air is coming into the range and contributes to inefficient ventilation of the shooter’s space.

If procedures are in place that prevent people from travelling over lead dusted areas when shooting or target changing, then large air flow velocities may not be necessary. What this means is that care must be taken when moving around the range while shooting is in progress. It is suspected that the high velocity air movements in some recommendations is in some part an attempt to eliminate the dust from settling within the range. Given New Zealand's shooting preference for Indoor Shooting to be a winter activity, this would probably entail large air conditioning systems to ensure that shooters shot in some degree of 'pleasant' and warm surroundings.

- Because of the cost involved of any such system, TSNZ recommends that the careful approach with regular cleaning of the range, a ventilation system that ensures air movement towards the targets and careful personal hygiene be the adopted procedure in minimising lead contamination of range users.

- The provision of a 'Lead Isolating Station' at the point where people enter the area forward of the firing points when changing targets would eliminate to a large degree the transfer of lead into the marking rooms and social areas of the range. Galoshes, gumboots, or any type of easily fitted shoe or overshoe would be appropriate to place at the Station.

First Aid

For Health and Safety, organisations that partake in ***potentially*** dangerous activities should ensure that there are persons present ***while the activity is in progress*** who have possession of current First Aid qualifications.

Minimum Requirements for Range Shooting

The minimum First Aid requirements for acceptable Range Operation are:

- A complete and current First Aid Kit within the range building or the immediate environs.
- A readily accessible list within the range or the immediate environs, of emergency medical services.
- An Action List that explains what to do in the event of a firearm accident that has caused injury.

TSNZ recommends its members attend an accredited First Aid course.

Note For the purposes of this Manual:

1. ***While the activity is in progress*** means at any time ***shooting*** is taking place on the range.
2. ***Immediate environs*** means within 50 metres of the firing point.
3. ***Complete*** means the First Aid Kit contains the minimum quantities and all components of the below list ***at all times*****,** and ***current*** means that the "used-by" date of individual components of the Kit have not lapsed.
4. St Johns and other First Aid trainers will willingly include the first Aid treatment of bullet wounds in their courses. Just notify them of the requirement to cover this in the course beforehand.

First Aid Officer's Role

- Check the contents of the First Aid Kits(s) against the contents list and replace used items. If any components have a "use - by" date then ensure that they are replaced before the expiry date.
- Insist and ensure that the Notebook is filled in.
- Ensure that the incident sheet is filled in and sent to the Executive Officer, TSNZ.

Accident / Incident Reporting Notebook

ALL items that are taken from the kit to use for ANY accident or incident MUST be written in the notebook. Note the name of the victim, the name of the person who removed the items, date and time, accident / incident description, what action was taken, what items were used, date any items replaced.

Notebook Discussion

The purpose of the notebook is to log accidents / incidents and any use of the kit. It is necessary to document this information so that a reliable log of events can be shown to have occurred. This will also assist the shooting fraternity in demonstrating that shooting ***is*** a safe sport. ***Please***, do not sweep incidents and accidents under the carpet. The practice of safe shooting will never be improved if events are not recorded, analysed and acted upon. The "fact" that TSNZ has difficulty recalling any firearm injury accident within any of its Club's ranges attests to a safety record second to none. Whether this "fact" is true is unknown. The fact is, TSNZ has received few reports. Nevertheless complacency must never creep into the sport and care and attention must be exercised at all times. A First Aid kit and trained personnel will ensure that safety is at the forefront of Club operations. ***Please play your part***.

Shooting Accident Reporting Procedure

If an incident occurs over and above what could be classed as a "non-shooting" accident [e.g. cut finger or graze] but is ***DIRECTLY*** related to firearms or shooting **AND** causes an injury to **any** person then the following **SHALL** occur:

- Carry out recommended First Aid procedures on the victim
- Notify Accident and Emergency services as necessary
- Ensure the victim is adequately cared for. [Over care is preferable to under care]
- As soon as practicable, and no later than 24hrs after the incident, notify the Police.
- Notify and send completed Incident Sheet to the Executive Officer, TSNZ, within 7 days of the incident.

Recommended First Aid Kit

A First Aid Kit specifically designed to provide for firearm accidents is listed below. These are available from the TSNZ at cost plus a small handling and postage fee.

A kit that meets these minimum requirements shall be installed in every TSNZ affiliated range.

- Wound dressings [size] [2]
- Wound dressings [size] [2]
- Crepe bandage 50mm wide [2]
- Roll of adhesive tape [1]
- Triangular bandages [2]
- Medical gloves [3 pair - 1x small 1x medium 1x large]
- Resuscitation mask [1]
- Box of sticky plasters [Assorted sizes] [1 packet]
- Forceps [1]
- Hepatitis / HIV warning sign [1]
- First Aid Book [St John or Red Cross] [1]
- Notebook and pen to record all accidents and the action taken
- Quick Reference Chart

The First Aid Kit is to be kept in a handy place in full view of range users, either in the range or in the social area.

The organisation that administers the range shall designate a First Aid Officer who shall ensure the First Aid Kit is kept complete and current. This person's name shall be written legibly on the First Aid Kit.

Each Club that uses the facility for shooting purposes will be made familiar, by the administering organisation's First Aid Officer, of the First Aid Kit's whereabouts and the correct procedure for notification of use.

Range Operation Manual (Range Safety Orders)

The Range Operation Manual is the handbook of the day to day operation of the range. It outlines the appropriate uses the range is certified for, the safety procedures, the allowed ammunition and firearms.

It is a Risk Assessment on the operations within the range environs.

It is good practise to include details such as titles, leases, rent agreements, plumbing and electrical certificates, plans of the range including plumbing and drainage and electrical wiring diagrams and fire escape plans. By including this type of information in the ROM (RSO), continuity will be maintained and important information will be easily accessible to future Club Members.

- Every range in which TSNZ affiliated Clubs shoot shall have a Range Operation Manual (RSO) within easy access at all times the range is operational.

- The following items are recommended to be included in a Range Operation Manual:

Where is the range?

Identify the range. Show, with the aid of maps and survey descriptions, the actual position of the range, its orientation, town and street.

Whose range?

Describe who owns, rents, leases the range.
Which organisation is responsible for the operation of the range.
Contacts, which must be kept up to date - this may include the current range committee.
It should outline procedures for other organisations using it - especially if the facility is used for purposes other than shooting. Another section of the manual could be kept aside for this in which it could be described what parts of the range are accessible to people - especially children as it is necessary to consider the effect of children having access to possibly lead contaminated atmosphere and soils inside the range area.

What sort of firearms / ammunition are allowed?

Rifle, pistol, air rifle, combination? What ammunition and firearms are permitted to be used on the range.

First Aid / Fire Plan / Approved Evacuation Plan

Describe where the exits are.
There will be a need to outline the requirement to keep fire exit doors clear. Exit signs next to all exits.
Where are the Alarm switches, Smoke Detectors, what type are they, who services them and when do they need to be checked?
First Aid kit, where is it, who looks after it, checks and replaces out of date or used items?

Shooting Procedures

Outline the conduct of shooting at this range.
Who is allowed to shoot?
Where are firearms allowed to be handled, cleaned, disassembled?
Who may issue ammunition to visitors? This procedure may differ from Club to Club but in all cases the issuing of ammunition to people without Firearms Licences must be strictly controlled. It is imperative that good auditing of ammunition usage is carried out and policed.

The Range Officer's function needs to be outlined.
Describe who has control of the shooters on the firing point.
What procedures must be adhered to when preparing to shoot, e.g.: changing targets, loading firearms, red light operation, verbal instructions expected during shooting.

Maintenance Procedures

What needs cleaning;

rubbish bins, ammo case rubbish, used targets.

Range cleaning procedures. The pertinent measures as outlined in the section on **Lead** of this Manual may be included here with specific reference to the techniques to be used on the particular range. This may include emptying bullet catchers, clean-up and disposal of brass and lead, clothing and protective equipment to be worn, recycling of old targets.

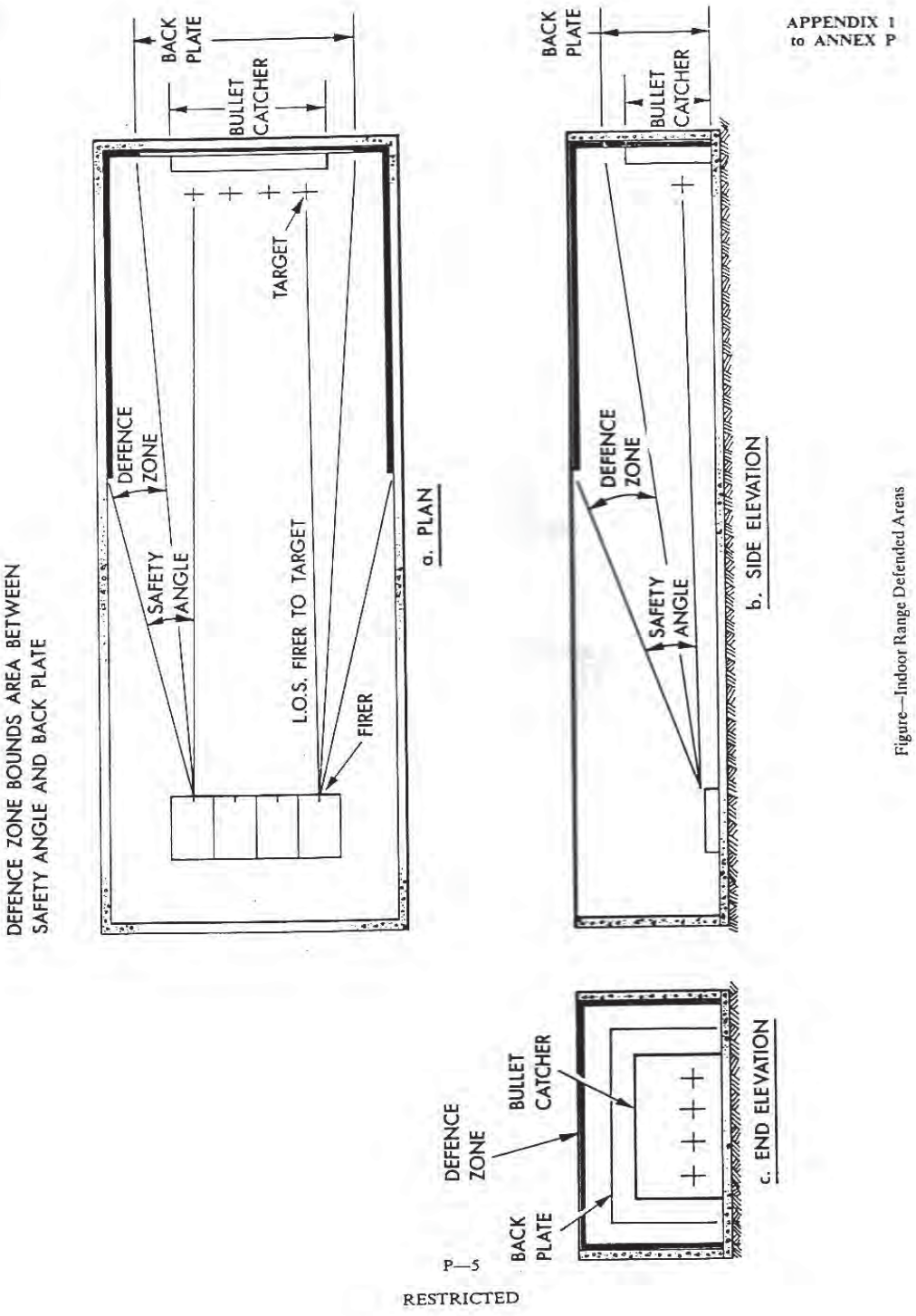
Where are the vacuum cleaner, brooms and cleaning chemicals kept?

Who is responsible?

An example of a Range Operation Manual (RSO) is included in Appendix 4.

Appendices

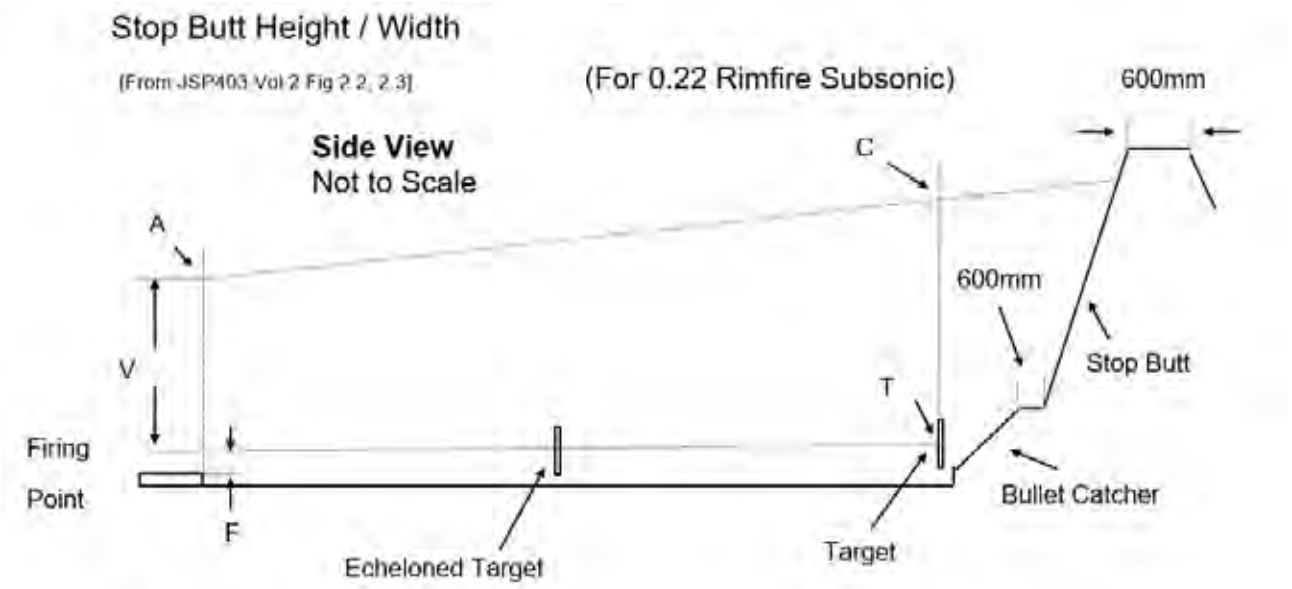
Appendix 1: Indoor Range Defended areas



Figure—Indoor Range Defended Areas

Appendix 2: Outdoor Range "No Danger Area" Range

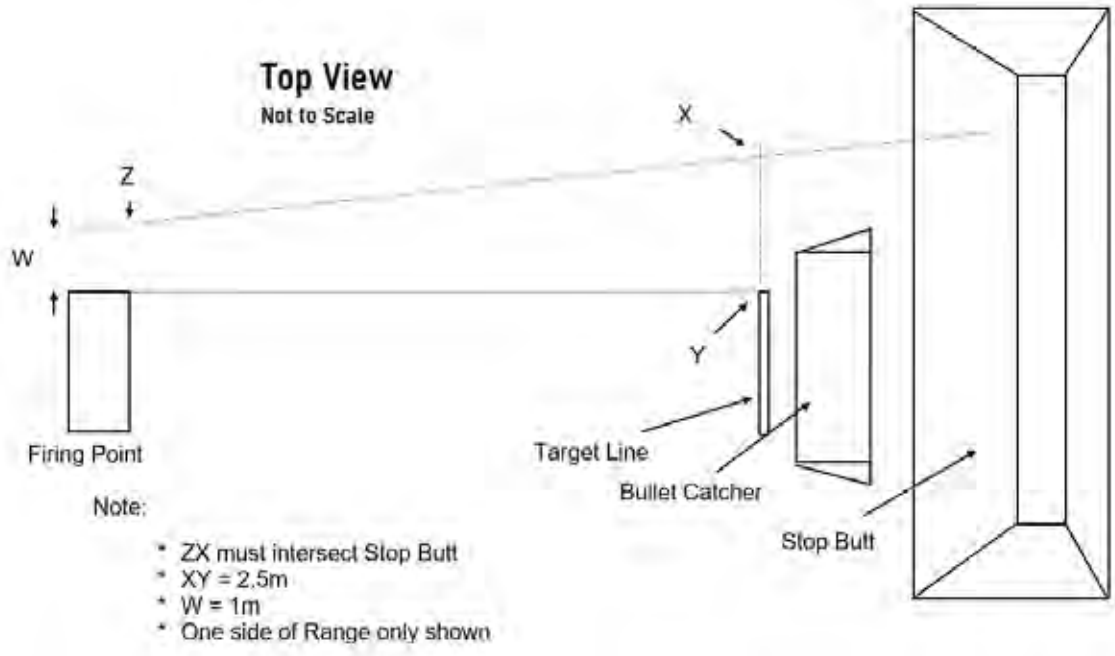
Stop Butt Height / Width



For 50m Range: F= 300mm for Prone, 800mm Kneeling, 1500mm Standing
V= 2.5m above F
C= 3.5m above T
T must be at centre of top target

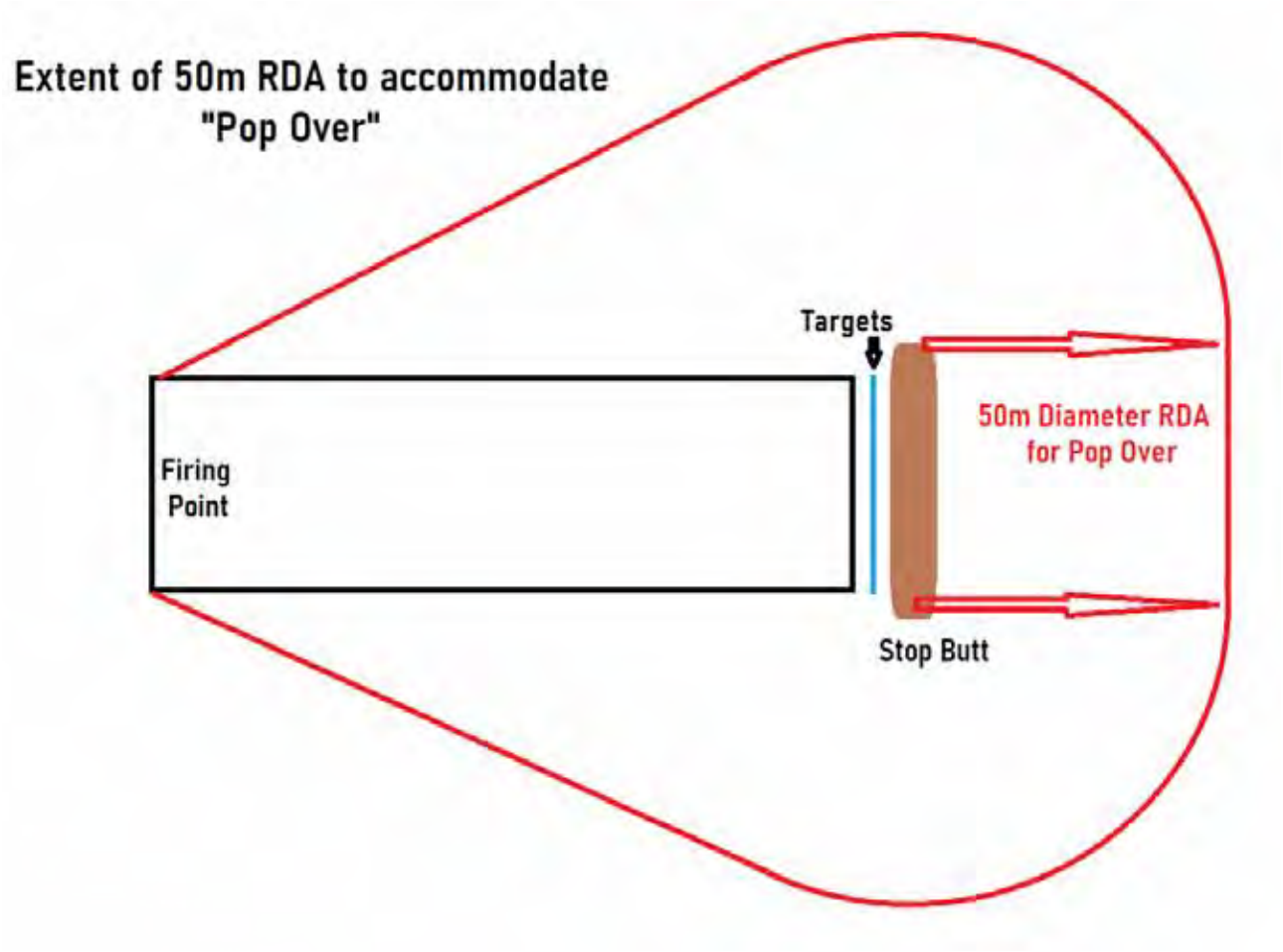
Note:

- Extension of line AC must intersect Stop Butt
- Minimum thickness of Bullet Catcher and Stop Butt must be 600mm



Note:

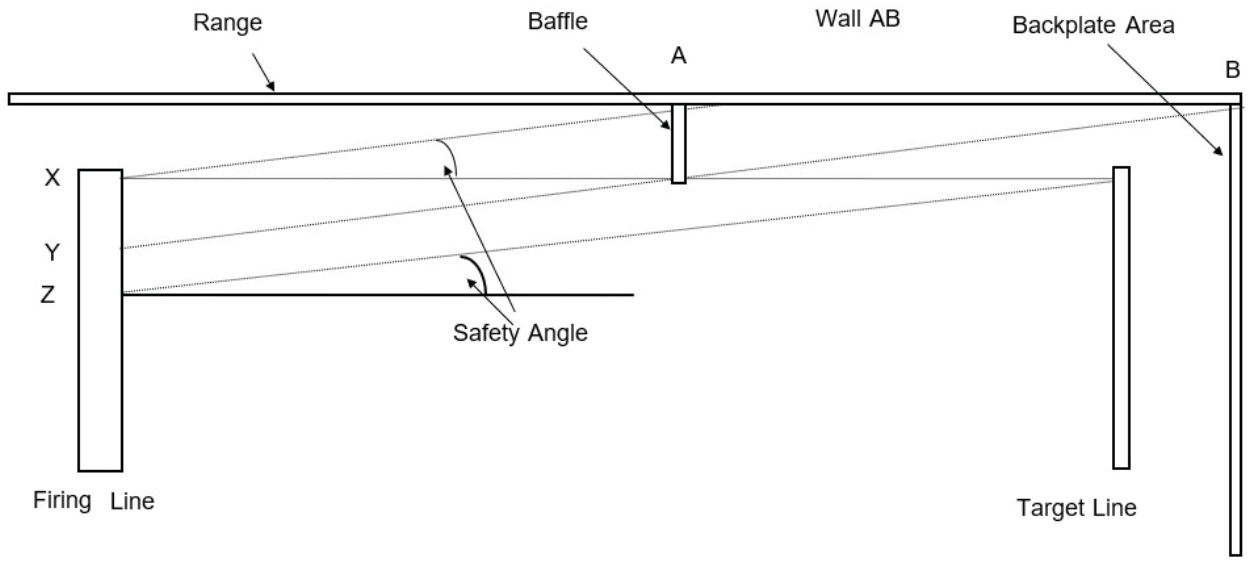
- ZX must intersect Stop Butt
- XY = 2.5m
- W = 1m
- One side of Range only shown


Extent of 50m RDA to accommodate
"Pop Over"
Targets
50m Diameter RDA
for Pop Over
Firing
Point
Stop Butt

Appendix 3: Baffles

Baffles - Example of Installation

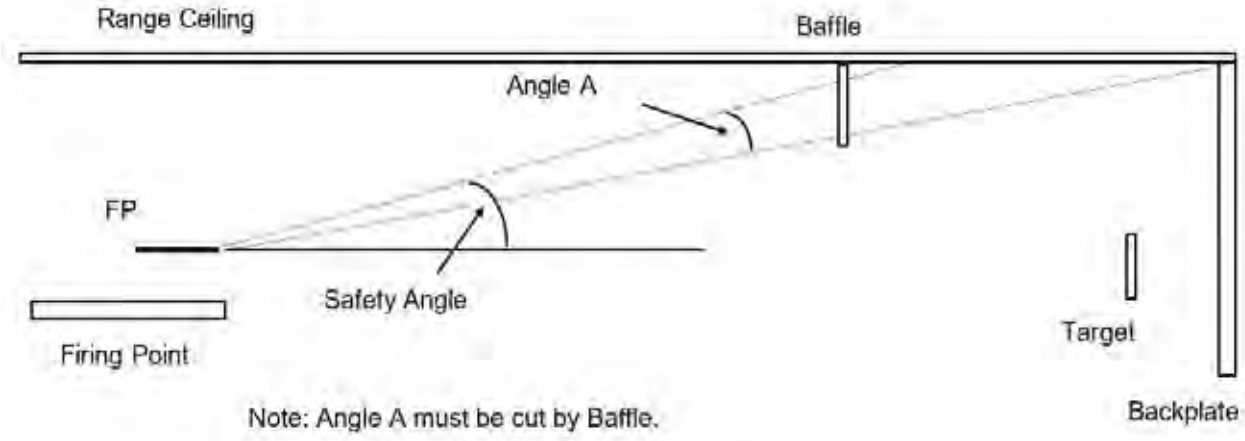
Top View
Not to Scale



Note:

- Baffle intercepts any shot from firing points between X & Y that are within the sideways safety angle, protecting wall AB.
- Shots fired between Y & Z are intercepted by Backplate area.
- If Backplate was only as wide as Target Line, then a Baffle would need to be placed between Target and Side wall intercepting line from Y to corner of wall.

Side View
Not to Scale

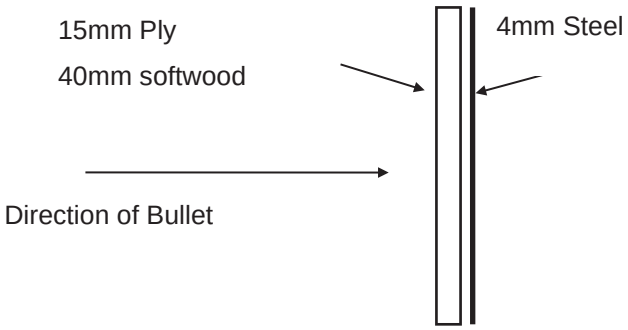


Baffles - Continued

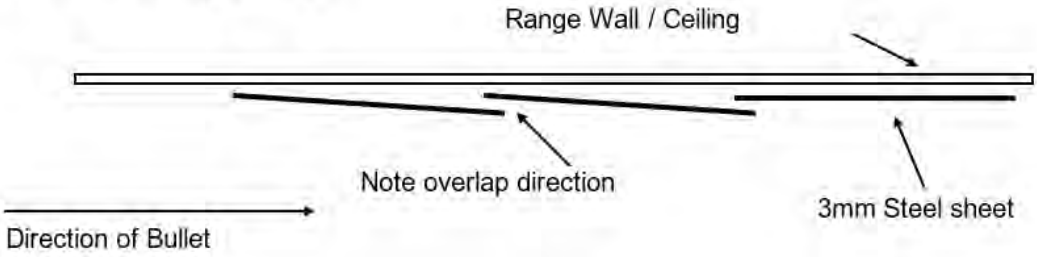
Points to note with Baffles are:

- There may be a need to place more than one baffle to cover the required angles that may be within the required safety angle
- See Table 1 page 11 and Table 2 page 17 for safety angles for different ranges.
- Being vertical plates that are placed at right angles to the line of fire means that the Baffle need to be able to stop a bullet and catch it. See examples of construction.

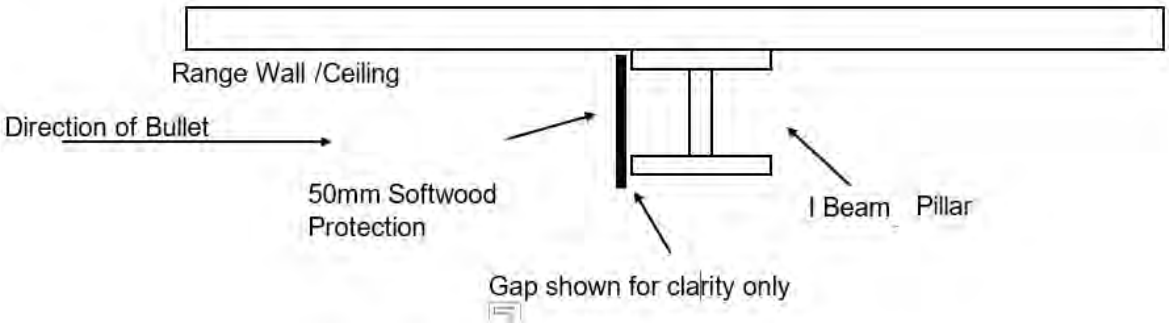
Baffle Example



Flush Wall / Ceiling Lining



I Beam / Pillar Protection -Ceiling or walls



Appendix 4: Range Safety Procedure - Example

Range Safety Procedure

Keene Range

Halford Place
Petone
Lower Hutt

Range Operator: Target Shooting Hutt Valley
PO Box 38 633, Petone, Lower Hutt

Location of Range: Adjacent to the Hutt River at the eastern end of Jackson St, Petone, Halford Place. It faces a north south direction in the longest dimension of the range.

Range Owners: The range building is owned by the TSHV. The property is owned by the Wellington Regional Council. The property is zoned Recreational Reserve.

Type of Range: There are two shooting ranges within the building situated side by side. The right hand range is used for 25yd 0.22 rimfire shooting. There are 10 x 0.22 rimfire firing points situated in the RH range in a 5 up 5 down layout. The left hand side range is used for 0.22 Rimfire and Air Rifle. There are 6 Air Rifle firing points or 8 x 0.22 rimfire firing points in a 4 up 4 down layout. The only permitted ammunition are 0.22 Rimfire and Air Rifle Pellets.

Description of Amenities: The walls are made of concrete block with galvanised iron roof. A social area with kitchen, toilets, marking room and Club cupboards are included within the building. Entry is via a side double door and fire egress is via a side door in the LH range. Power is turned on at the switch board inside the first door on the right after entry. The board is then immediately on the left wall. The marked main switch turns on the Hot Water and lights. Heater switches are arranged as marked. User Clubs have access to in individual locked cupboard inside the LH range.

First Aid / Fire Plan: A first Aid kit is held in the kitchen area, on the wall to the right of the servery. It includes the basic equipment as outlined in the TSNZ Range Manual. This shall be kept current by the TSHV designated First Aid Officer.

Shooting Procedures: Shooting may be carried out concurrently on both ranges. Air Rifle or rimfire shooting may be held in the LH range at the same time as the RH range is being used. A door between the two ranges that is situated approx 20m down the range shall be locked if Air Rifle is in the LH and rimfire is in the RH range. It may remain unlocked to facilitate target changing but only if both ranges are under the control of one designated Range Officer.

Shooting may only be carried out under the control of a designated Range Officer. There shall be at least two persons present within the Range while shooting is in progress.

- Rifles shall be cocked at the shoulder. That is, the rifle may be loaded with a live round with the rifle off the shoulder, but the bolt cocked or action block must be closed after the rifle is placed on the shoulder. An Empty Chamber Flag shall be inserted in all rifles when not in use.

Each Shooting Club that uses this range may vary their shooting programme to suit their circumstances but at all times safe and acceptable procedures shall be followed.

Red warning lights: Shall operate in the following manner when shooting is active on the ranges:

- Each range shall have a Red Light visible to all shooters. It shall remain on until the Range Officer gives the order to remove safety flags, load and fire. A complementary Red Light situated close to the entry doors to the range that shall come on when the Range Officer switches the Shooter's Red Light off. This implies that the lights are electrically interconnected. These lights shall be positioned at the entry door from the social area of the range and also at the door that opens into the RH range from the LH range at the firing point end.

The Range Officer shall follow and issue instructions for the different matches as outlined in the attached Range Instruction Sheet. The Range Officer shall have absolute control of shooting at all times.

Target Changing: Persons changing targets shall don overshoes at the Lead Isolation Station situated at the door just in front of the left hand range firing point. The TSHV Executive shall provide sufficient overshoes suitable for persons to wear while changing targets.

- No persons under the age of 12 yrs shall be forward of the firing point at any time.

Range Maintenance Procedures: The following regular maintenance programme shall be followed by all users of the Keene Range:

1. All rubbish shall be removed weekly. The TSHV shall organise a roster each year of duty Clubs who shall be responsible for the regular cleaning of the Keene Range.
2. All 'empty' ammunition boxes shall be checked for the possibility of live rounds being inadvertently left in them before placing in the rubbish.
3. Individual Clubs are responsible for ensuring that the Keene Range is tidy at the end of their designated shooting night.
4. The kitchen shall be kept hygienic, tidy and all dishes washed and put away in the appropriate place.

5. The TSHV Executive shall be responsible for ensuring that cleaning material including dishwashing fluid, toilet cleaners and utensils are adequate.
6. All equipment, fittings and chattels shall remain the property of the TSHV. The TSHV Executive shall be responsible for the upkeep of all equipment, fittings and chattels.
7. Specific equipment that Clubs use shall be the responsibility of the individual Clubs. This includes Club owned marking boards, rifles, scopes etc. These items shall be kept under lock and key in the appropriate Club cupboards.
8. The cleaning of the range of lead dust, the emptying of the bullet catchers, the upkeep of the lighting shall be the responsibility of the TSHV Executive. The TSHV shall organise (at least) yearly working bees to ensure this is carried out regularly.

Non Shooting Club Use: It may be appropriate at times to rent, lease or lend the facilities of the Keene Range to other organisations not involved with shooting. The following Code of Use shall be outlined to these organisations as they arrange the use of the Keene Range:

- No persons may enter the shooting range area while the organisation has tenure. This is to ensure that the possibility of people being exposed to lead is reduced or eliminated.
- They shall clean the Keene Range at the completion of each days use.
- They shall keep the kitchen tidy and cleaned. All rubbish generated by them shall be removed.
- They shall leave all paraphernalia associated with shooting alone.
- All electricity shall be turned off when they leave.

Club/Association Rifle and Ammunition Security.

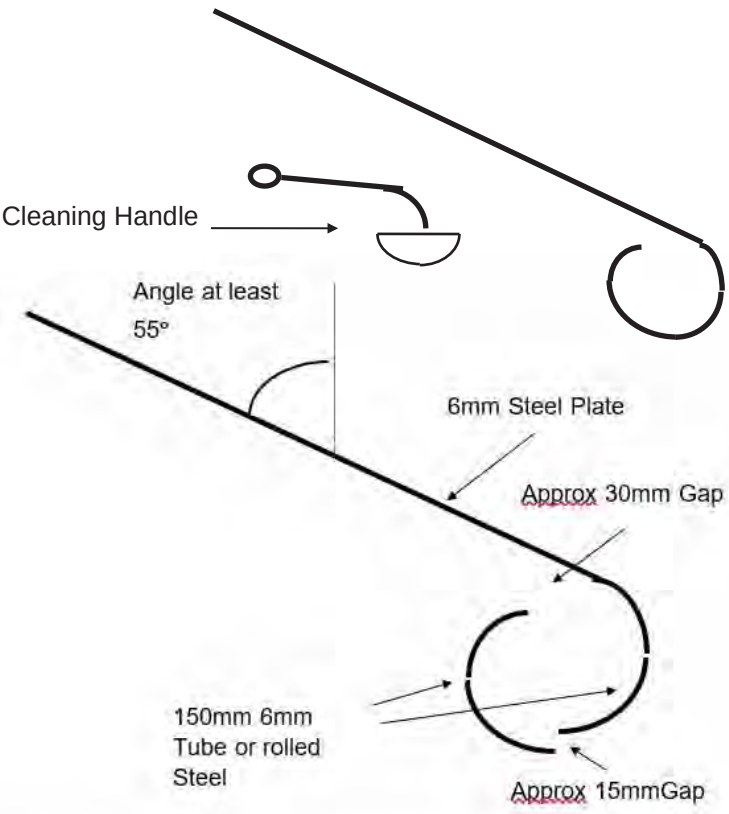
All rifles and ammunition shall be stored in secure cabinets or safes that are fit for purpose and comply with current firearms regulations.

Appendix 5: Bullet Catcher - Examples

Wainuiomata Catcher

[From Wainuiomata SRC design and use]

Mark I

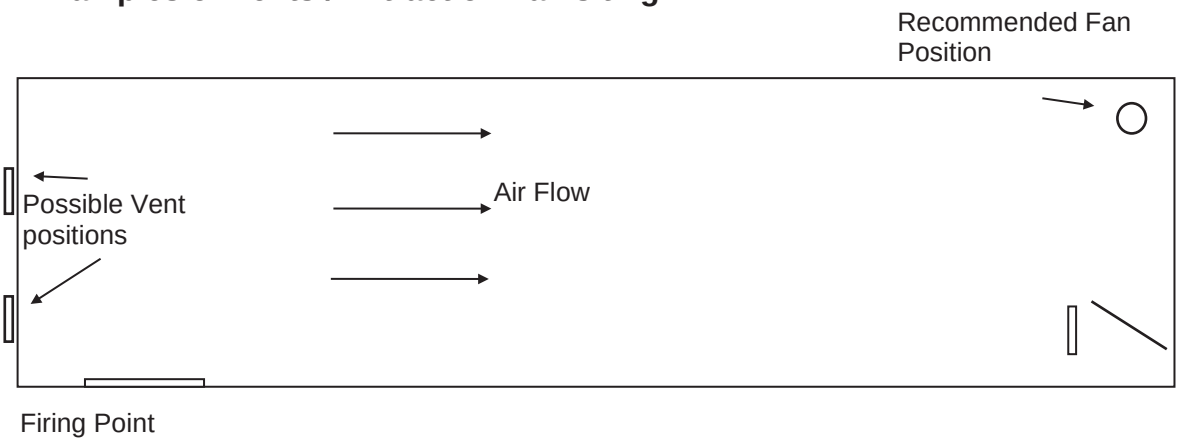


Note:

- The result of testing with an adjustable Test Rig, it was found that an angle less than 53° caused a bullet hitting the plate to break up. At angles greater than 53° the bullet did not. Thus the requirement to make sure the angle is > 55°.
- Mark I design did not incorporate the gap at the bottom of the tube. The bullet remains were left in the tube to be hit by later bullets. This meant extra lead dust being generated and regular cleaning was required. A semicircle of steel attached to a handle is used to scrape the remains out the end of the tube. The idea behind the gap is to allow the bullet to drop out of the tube and decrease the amount of lead dust generated. The bottom of the left hand tube needs to have a downward slope to assist the lead to fall out.
- One noticeable effect is the lack of pitting at high impact zones, ie sighter areas, as compared to more vertical plates.

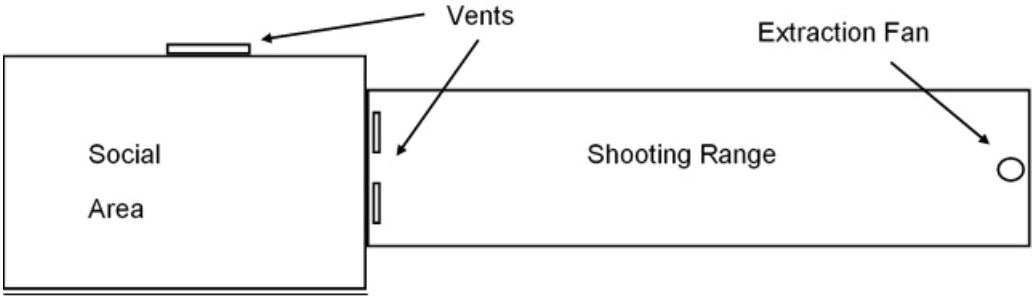
Appendix 6: Ventilation of Ranges

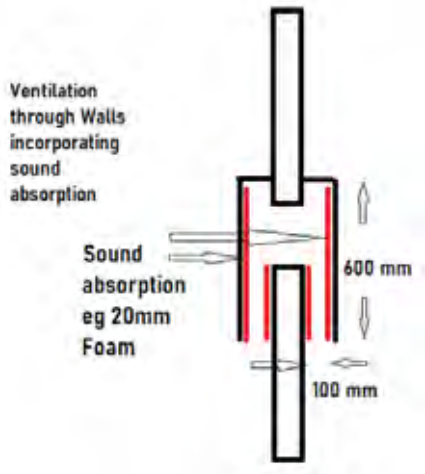
Examples of Vents / Extraction Fan siting



Note:

- Ensure Gaps throughout shooting range are eliminated. This will ensure that most of the air extracted by the fan is inside the range.
- A number of vents at the shooting end (more than 2) should be installed. This will ensure a more even flow and less turbulence around the shooter.
- Ensure that air is freely available from the area where the air is coming through the vents into the shooting range. If this is the social area, install a vent to the outside in the social area.
- The fan(s) should be operating at all times any part of the range is in use.





Appendix 7

This Appendix will contain examples of constructional details that are extracted from JSP403 and other Manuals.

Examples that are directly relevant to Rimfire Indoor, 50m Outdoor and Air Rifle Ranges have been included.

They are presented as examples of “ideas with experience”.

Range builders and or renovators are actively encouraged to design innovations into any range they are involved with.

The only criteria TSNZ will insist upon are that:

The design works and

It fulfils the opening paragraph of Range Construction. Page 10

References

JSP403
Copies available from internet

Merck Manual
A comprehensive Manual on Chemical Injuries, Poisonings, Treatments
Available on the Internet www.merck.com

TSNZ Rule Book

Range Inspection Check List

AECOM New Zealand Limited +64 3 966 6000 tel
Level 2, 2 Hazeldean Road +64 3 966 6001 fax
Addington, Christchurch 8024
P O Box 710, Christchurch MC
Christchurch 8140
New Zealand
www.aecom.com

17 September 2021

Andy Coker
Community Facilities Team Leader
Waimakariri District Council
Private Bag 1005
Rangiora 7440

Dear Andy

Limited Soil Investigation – Former Rifle Range, Oxford

1.0 Introduction

Waimakariri District Council (WDC) engaged AECOM New Zealand Limited (AECOM) to undertake a shallow soil quality investigation at the former Oxford Rifle Range located directly adjacent to Pearson Park Pavilion, Dohrmans Road, Oxford (the Site; Figure 1 in Appendix A).

AECOM understands WDC wish to assess the potential presence of lead contamination in shallow soils related to the former use of the Site as a rifle range. This factual letter report presents the results of the investigations.

1.1 Background

The Site is located adjacent to the eastern wall of the Pearson Park Pavilion, part of Pearson Sports Park (**Figure 1**, **Appendix A**).

Owing to the known historic use of the Site as a former rifle range, a Hazardous Activity and Industrial List (HAIL[1]) activity '*C2. Gun clubs or rifle ranges, including clay targets clubs that use lead munitions outdoors',* it is considered likely that the land is classified as a "piece of land" under Section 5 (7) of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-CS).

2.0 Objective

The objective of the shallow soil investigation is to assess the presence of lead contamination in shallow soils at the Site to:

- Characterise lead concentration in shallow soils prior to planned upgrades at the Site.
- Provide recommendations to WDC on how to maintain/manage ongoing lead exposure once the range is back in use.

3.0 Scope of Works

To meet the objectives, AECOM completed the following scope of work:

- Preparation of a site-specific health and safety plan and safe work method statement.
- Completion of underground utility clearance in accordance with AECOM standard procedures. This included submitting a request for plans via Beforeudig and engaging an independent subcontractor to complete a scan using a cable avoidance tool (CAT) and ground penetrating radar (GPR) to identify potential underground services prior to breaking ground.
- Completion of 10 soil bores to 0.3 m bgl across the Site via hand auger.
- Collection of soil samples from the hand auger holes from 0.0 to 0.15 m bgl and 0.15 to 0.30 m bgl for material description and submission to RJ Hill Laboratories, Christchurch under standard Chain of Custody (COC) documentation for analysis of total recoverable lead.

[1] *Hazardous Activities and Industries Limit (HAIL): October 2011.* Ministry for the Environment, 2011.

- Collection of sawdust samples from the surface of the floor for laboratory analysis of arsenic, chromium, copper and lead (due to field observation that a layer of sawdust was present across the Site).
- Preparation of this factual report.

4.0 Environmental Setting

A desktop review was undertaken to assess the Site environmental setting as summarised below.

4.1 Site Description

The Site is currently used as a storage space for various outdoor equipment and cleaning supplies. The Site surface comprised of sawdust, underlain by rounded pebbles and cobbles.

The Site is immediately bounded by the Pearson Pavilion to the West, a grassed area followed by the Oxford Squash Club to the East, a grassed area to the South and a sealed area to the North.

The Site and surrounding area are zoned as “Residential 2” under the WDC District Plan[2].

4.2 Geology / Hydrogeology

According to the 1:250,000 geological map of the area (https://data.gns.cri.nz/geology/), the Site is underlain by late Pleistocene river deposits consisting of a brownish-grey, unweathered variable mix of gravels/sand/silt/clay in low river terraces.

Based on Environment Canterbury’s (ECAN) records, the closest registered bore to the site is approximately 6 km to the west.

The nearest surface water body is Eyre River located approximately 500 m south of the site. An open channel / un-named drain is present directly south east of the Site and was observed to be flowing at the time of sampling.

4.3 Site History

A review of publicly available historic aerial photographs indicates the Site was first constructed between 1965 and 1969. Prior to this, the Site was a vegetated area adjacent to the rugby field.

5.0 Analyte and Assessment Criteria

Based on the objectives of the soil investigation and the known former Site use, the contaminant of concern was limited to lead (Pb). Further analysis of the sawdust present at the surface of the Site for arsenic (As), copper (Cu) and chromium (Cr) concentrations was also undertaken to assess if the source wood had been treated with chromated copper arsenate (CCA).

Based on the proposed use of the Site as a recreational facility, analytical results have been compared to guideline criteria in general accordance with the hierarchy defined by MfE Contaminated Land Management Guideline No 2 (MfE 2002). **Table 1** presents the adopted assessment criteria.

Table 1 Adopted Assessment Criteria

Assessment	Analyte	Selected Guideline
Recreational land use	Heavy Metals (Pb) - Soil	NES-CS: Soil contaminant standards (SCS) for total metal concentrations. Land Use: Recreation For benchmarking purposes the analytical results were also compared to ECan background concentrations[3] for the applicable regional soil category (identified by ECan as a Gley Soil).

[2] https://waimakariri.isoplan.co.nz/eplan/#/Property/ accessed on 13 September 2021.
[3] Environment Canterbury, 2007. Background concentrations of selected trace elements in Canterbury soils. (Referred to as Background Concentrations). Numbers obtained from Canterbury Maps online database https://mapviewer.canterburymaps.govt.nz/ listed as Trace Elements Level 2 (ECan Background Concentrations)

Assessment	Analyte	Selected Guideline
	Heavy Metals – Sawdust (As, Cr, Cu, Pb)	For benchmarking purposes, sawdust heavy metal concentrations have also been compared to the above SCS and background concentrations, however AECOM note that these are not directly applicable.

6.0 Investigation Results

Laboratory analytical results are summarised in Table B1 in **Appendix B**, a copy of the laboratory reports and chain of custody documentation is included in **Appendix C** and Site photographs are included in **Appendix D**. The sample locations are presented on **Figure 2** in **Appendix A**.

6.1 Field Observations

Numerous shell casings were observed throughout the upper 0.1 m of material on the site. The upper layer (0.0-0.15) was comprised of a mix of sawdust, brown clayey silt fill and rounded pebbles and cobbles.

6.2 Analytical Results

Lead concentrations exceeded the ECAN background soil concentration of 19.3 mg/kg in all ten surface soil samples and the sawdust sample.

Lead concentrations in four of the analysed soil samples and the sawdust sample exceeded the NES-SCS for recreational land use. The exceedances were reported in soil samples SB01, SB02, SB03, SB07 and in the sawdust sample, located at either end of the former rifle range (**Figure 2** in **Appendix A**). At those locations, the lead concentrations ranged from 2,400 to 18,700 mg/kg compared to a range of 35 to 131 mg/kg in the samples collected from the middle of the former rifle range.

The arsenic, copper and chromium concentrations in the sawdust sample were below the NES-SCS for recreational land use and their respective ECAN background soil concentrations except for Copper.

7.0 Summary

7.1 Soil Quality

Lead contamination above the NES-SCS criterion was identified in the surface soil and sawdust at either ends of the former rifle range where the bulk of the shell casings were observed and above the background soil concentrations across the Site. The primary exposure pathway for human receptors would be inhalation or ingestion of dust with elevated lead concentrations. The proposed installation of a concrete slab as part of planned upgrades at the Site could adequately mitigate the risk of human exposure to historical lead contamination by making the inhalation or ingestion pathways incomplete.

Soil and sawdust that may require removal as part of planned works is unlikely to be accepted as cleanfill and will need to be disposed at an appropriately licensed facility.

7.2 Ongoing Use

Based on information provided by WDC, AECOM understand that the Site is to be recommissioned as a rifle range. In order to manage potential lead exposures, AECOM recommend consideration of the information outlined in the Ministry for Health document '*The Environmental Case Management of Lead exposed Persons, Guidelines for Public Health Units*' Appendix 5 and Appendix 6[4] present 'Health advice for indoor shooters' and the Auckland Regional Public Health Service document 'Minimising lead exposure in shooting club ranges' which have been included as **Appendix E** of this document for WDC's convenience.

[4] Ministry of Health, Revised March 2021. The Environmental Case Management of Lead-exposed Persons, Guidelines for Public Health Units.

Yours faithfully

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Natalie Rowe
Associate Director – Environment
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Enclosed:
Attachment A – Figures
Attachment B – Tables
Attachment C – Photo Log
Attachment D – Lab Report
Attachment E – Ministry for Health Guidance Document

8.0 Limitations

The information contained in this document was produced by AECOM New Zealand Limited for the sole use of the Waimakariri District Council (the Client). No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

AECOM has relied on information provided by the Client and by third parties (Information Providers) to produce this document and arrive at its conclusions. AECOM has not verified information provided by the Information Providers (unless specifically noted otherwise) and we assume no responsibility and make no representations with respect to the adequacy, accuracy or completeness of such information. No responsibility is assumed for inaccuracies in reporting by the Information Providers including, without limitation, by the Client's employees or representatives or for inaccuracies in any other data source whether provided in writing or orally used in preparing or presenting the document.

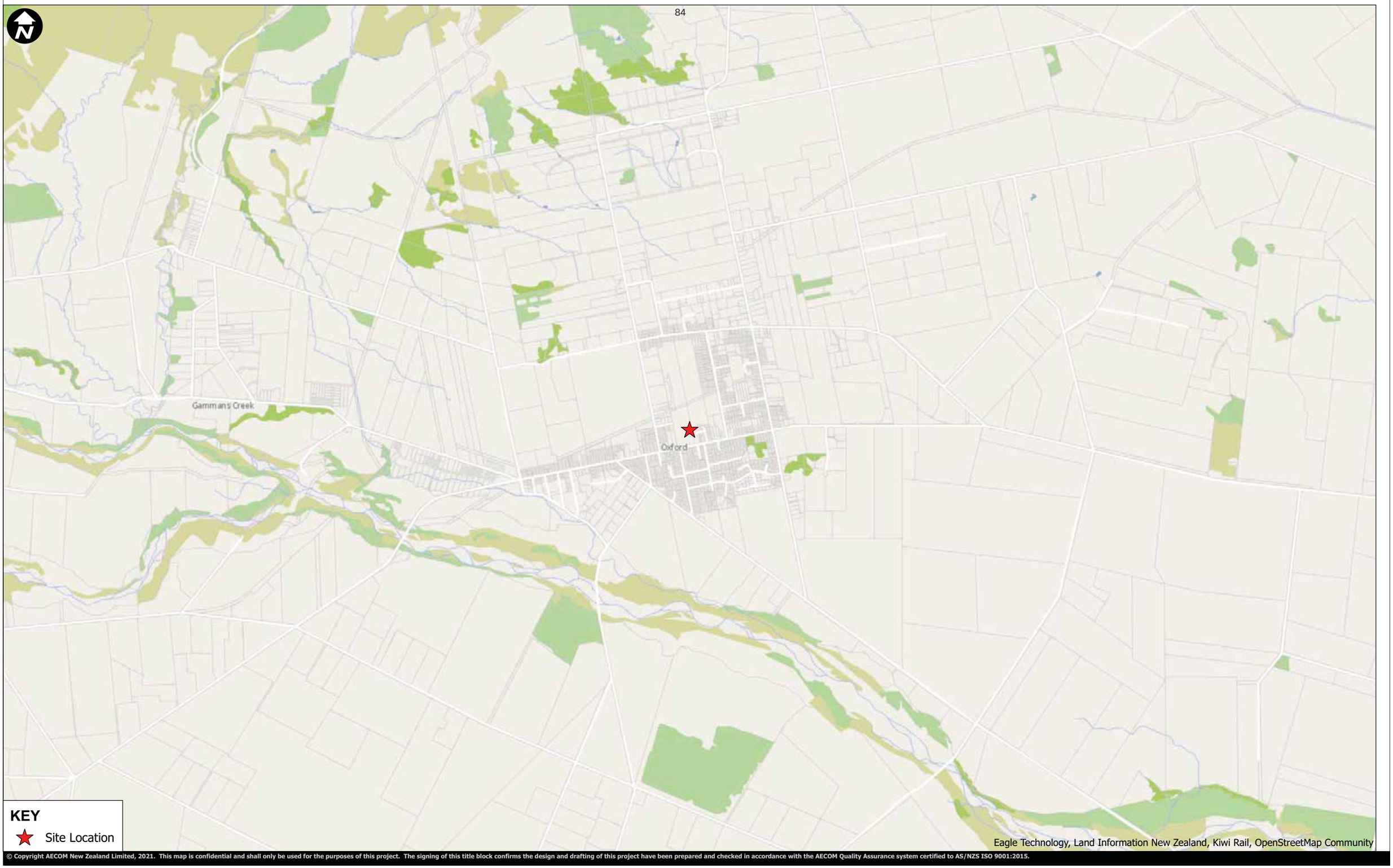
This document was prepared as per the "Proposal for Shallow Soil Investigation, Pearson Park Pavilion, Oxford" ("the Agreement") dated 3 August 2021, and as agreed to by the Client. From a technical perspective, the subsurface environment at any site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic conditions can have substantial impacts on water and chemical movement. Uncertainties may also affect source characterisation assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance.

AECOM's professional opinions are based upon its professional judgement, experience, and training. These opinions are also based upon data derived from previous reports and the testing and analysis described in this document. It is possible that additional testing and analysis might produce different results and/or different opinions. AECOM has limited its investigation to the scope agreed upon with the Client. AECOM believes that its opinions are reasonably supported by the testing and analysis that have been done, and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at this time. That standard of care may change and new methods and practices of exploration, testing, analysis and remediation may develop in the future, which might produce different results.

AECOM's professional opinions contained in this document are subject to modification if additional information is obtained, through further investigation, observations, or validation testing and analysis during remedial activities.

ATTACHMENT A – FIGURES

ISO A3 297mm x 420mm



Last saved by: BRYANTM (2021-09-09) Last Plotted: 2018-01-15
Filename: C:\Temp\60644986\900_CAD_GIS\920_GIS\02_Maps\60644986.aprx

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PROJECT
OXFORD RIFLE RANGE

CLIENT
WAIMAKARIRI DISTRICT COUNCIL

KEY PLAN

SPATIAL REFERENCE
Scale: 1:25,000 (A3 size)
190 95 0 190 380 570 Meters
Map features depicted in terms of NZTM 2000 projection.
Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2021

PROJECT MANAGEMENT

Approved	S.Hay	Date	
Checked	E.Reisman	Date	8/09/2021
Designed	M.Bryant	Date	8/09/2021
Drawn	M.Bryant	Date	8/09/2021

ISSUE/REVISION

Rev	Date	Description
A	08.09.21	Draft for Review

PROJECT NUMBER
60644986

SHEET TITLE
Site Location

MAP NUMBER
Figure 1

ISO A3 297mm x 420mm

85

Sawdust N-Side

SB01

SB02

SB03

SB04

SB10

SB05

SB09

SB06

SB08

SB07

KEY

- Soil Bore Locations
- Sawdust Sampling Location
- Site Footprint

Last saved by: BRYANTM (2021-09-16) Last Plotted: 2018-01-15
Filename: C:\Temp\60644986\900_CAD_GIS\920_GIS\02_Maps\60644986.aprx

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PROJECT

OXFORD RIFLE RANGE

CLIENT

WAIMAKARIRI DISTRICT COUNCIL

KEY PLAN

SPATIAL REFERENCE

Scale: 1:250 (A3 size)

1.5 0.75 0 1.5 3 4.5 Meters

Map features depicted in terms of NZTM 2000 projection.

Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2021

PROJECT MANAGEMENT

Approved	S.Hay	Date	
Checked	E.Reisman	Date	8/09/2021
Designed	M.Bryant	Date	8/09/2021
Drawn	M.Bryant	Date	8/09/2021

ISSUE/REVISION

Rev	Date	Description
A	16.09.21	Draft for Review

PROJECT NUMBER

60644986

SHEET TITLE

Sampling Location Plan

MAP NUMBER

Figure 2

ATTACHMENT B – TABLES

Table B1 - Analytical Results

		Arsenic	Chromium[4]	Copper	Lead
NES SCS[1]	NES SCS for Recreation Land Use	80	2,700	>10,000	880
ECAN Background[2]	Gley Soils	11	19.3	16.425	19.3

Sample location	Depth (m bgl)	Field ID	Lab ID	Date Sampled	Description	Soil Guideline Soil Type*				
SB01_0.0 - 0.15	0.0 - 0.15	SB01_0.0 - 0.15	2691955.1	17/08/2021	Brown clayey SILT with pebbles/cobbles, and sawdust	Clayey SILT	-	-	-	**2,400**
SB02_0.0 - 0.15	0.0 - 0.15	SB02_0.0 - 0.15	2691955.2	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	**14,300**
SB03_0.0 - 0.15	0.0 - 0.15	SB03_0.0 - 0.15	2691955.3	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	**4,000**
SB04_0.0 - 0.15	0.0 - 0.15	SB04_0.0 - 0.15	2691955.4	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	88
SB05_0.0 - 0.15	0.0 - 0.15	SB05_0.0 - 0.15	2691955.5	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	83
SB06_0.0 - 0.15	0.0 - 0.15	SB06_0.0 - 0.15	2691955.6	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	131
SB07_0.0 - 0.15	0.0 - 0.15	SB07_0.0 - 0.15	2691955.7	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	**3,600**
SB08_0.0 - 0.15	0.0 - 0.15	SB08_0.0 - 0.15	2691955.8	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	117
SB09_0.0 - 0.15	0.0 - 0.15	SB09_0.0 - 0.15	2691955.9	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	35
SB10_0.0 - 0.15	0.0 - 0.15	SB10_0.0 - 0.15	2691955.10	17/08/2021	Brown clayey SILT with pebbles/cobbles and sawdust	Clayey SILT	-	-	-	48
Sawdust Sample North	0.0 - 0.1	Sawdust N-side	2691955.21	17/08/2021	Sawdust	-	10	18	18	**18,700**

Notes:

All results and criteria are expressed in mg / kg dry weight.

[1] Ministry for the Environment, 2011. Resource management (National environmental standard for assessing and managing contaminants in soil to protect human health) regulations 2011. Referred to as the NES SCS.

[2] Environment Canterbury, 2007. Background concentrations of selected trace elements in Canterbury soils. Addendum 1: Additional samples and Timaru specific background levels. (Referred to as Background Concentrations).

[3] Environment Canterbury, 2007. Background concentrations of selected trace elements in Canterbury soils.
(Referred to as Background Concentrations). Numbers obtained from Canterbury Maps online database https://mapviewer.canterburymaps.govt.nz/ listed as Trace Elements Level 2

[4] Chromium VI has been adopted as conservative approach.

Grey text - below laboratory limt of reporting (LOR).

Bold and Shaded Blue - Exceeds the NES SCS for health for inorganic substances for commercial / industrial unpaved or NEPM HIL for Commercial / Industrial Land Use.

underlined - Exceeds the published Background concentrations for the surrounding area

m bgl - metres below ground level.

ATTACHMENT C – PHOTO LOG

AECOM Imagine it. Delivered.

PHOTOGRAPHS

Client Name:	Site Location:	Project No:
Waimakiriri District Council	Oxford, Canterbury	60644986

Photo No.	Date:
1	17-Aug-21

Description:

Rugby field located to the north of the Site.

Photo No.	Date:
2	17-Aug-21

Description:

North side entrance to the Site.

AECOM Imagine it. Delivered.

PHOTOGRAPHS

Client Name:	Site Location:	Project No:
Waimakiriri District Council	Oxford, Canterbury	60644986

Photo No. 3	Date: 17-Aug-21

Description:

Surface conditions at the south end of the Site.

Photo No. 4	Date: 17-Aug-21

Description:

Utility locater sweeping the east side of the Site.

AECOM Imagine it. Delivered.

PHOTOGRAPHS

Client Name:	Site Location:	Project No:
Waimakiriri District Council	Oxford, Canterbury	60644986

Photo No. 5	Date: 17-Aug-21

Description:

SB01 sample jars adjacent to soil bore location.

Photo No. 6	Date: 17-Aug-21

Description:

SB01 sample depth.

AECOM Imagine it. Delivered.

PHOTOGRAPHS

Client Name:	Site Location:	Project No:
Waimakiriri District Council	Oxford, Canterbury	60644986

Photo No. 7	Date: 17-Aug-21

Description:

Cobble + Pebble diameter

Photo No. 8	Date: 17-Aug-21

Description:

SB07 soil sampling location. Bullet shells scatteraed atop sawdust on ground surface.

AECOM

ATTACHMENT D – LAB REPORT

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	AECOM New Zealand Limited	**Lab No:**	2691955 SPv1
Contact:	S Hay C/- AECOM New Zealand Limited PO Box 710 Christchurch 8140	**Date Received:**	01-Sep-2021
		Date Reported:	06-Sep-2021
		Quote No:	81048
		Order No:	60644986 Task 1.91
		Client Reference:	60644986 Task 1.91
		Submitted By:	Eli Reisman

Sample Type: Soil

Sample Name:	SB01_0.0-0.15 17-Aug-2021 11:45 am	SB02_0.0-0.15 17-Aug-2021 12:15 pm	SB03_0.0-0.15 17-Aug-2021 12:40 pm	SB04_0.0-0.15 17-Aug-2021 12:55 pm	SB05_0.0-0.15 17-Aug-2021 1:05 pm
Lab Number:	2691955.1	2691955.2	2691955.3	2691955.4	2691955.5
Total Recoverable Lead mg/kg dry wt	2,400	14,300	4,000	88	83

Sample Name:	SB06_0.0-0.15 17-Aug-2021	SB07_0.0-0.15 17-Aug-2021 1:25 pm	SB08_0.0-0.15 17-Aug-2021 1:40 pm	SB09_0.0-0.15 17-Aug-2021 1:50 pm	SB10_0.0-0.15 17-Aug-2021 11:50 am
Lab Number:	2691955.6	2691955.7	2691955.8	2691955.9	2691955.10
Total Recoverable Lead mg/kg dry wt	131	3,600	117	35	48

Analyst's Comments

Appendix No.1 - Chain of Custody

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-10
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-10
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-10
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 06-Sep-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

95

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Hamilton 3204
Private Bag 3205
Hamilton 3240, New Zealand

T 0508 HILL LAB (44 555 22
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **269 1955**

Date Recv: 01-Sep-21 15:03

Received by: Jess Phillips

3126919552

Quote No

Primary Contact	Simon Hay	251982
Submitted By	Simon Hay	251982
Client Name	AECOM New Zealand Limited	53080
Address	PO Box 710 Christchurch 8140, New Zealand	
Phone	03 966 6000 *Mobile* 021-609-564	
Email	eli.reisman@aecom.com	

Charge To

Client Reference 60644980 Task 1.9.1

Additional Client Ref

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☒ *Email Primary Contact* ☐ *Email Submitter* ☐ *Email Client*

☒ *Email Other* eli.reisman@aecom.com

☐ *Other*

Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories *Date & Time:*

Name:

☐ *Tick if you require COC to be emailed back* *Signature:*

Received at Hill Laboratories *Date & Time:*

Name:

Signature:

Condition ☑ *Room Temp* ☐ *Chilled* ☐ *Frozen* *Temp:* 18.8

☐ Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ **Low** ☑ **Normal** ☐ **High**

☐ **Urgent** (ASAP, ~~extra charge applies, please contact lab first~~)

Requested Reporting Date:

Quoted Sample Types

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	SB01_0.0-0.15		Soil	Lead
2	SB02_0.0-0.15			
3	SB03_0.0-0.15			
4	SB04_0.0-0.15			
5	SB05_0.0-0.15			
6	SB06_0.0-0.15			
7	SB07_0.0-0.15			
8	SB08_0.0-0.15			

96

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street Hamilton 3204
Private Bag 3205
Hamilton 3240, New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Office use only (Job No)

Quote No

Primary Contact Simon Hay 251982

Submitted By Simon Hay 251982

Client Name AECOM New Zealand Limited 53080

Address PO Box 710
Christchurch 8140, New Zealand

Phone 03 966 6000 *Mobile*

Email

Charge To

Client Reference See Other Sheet

Additional Client Ref

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☐ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories *Date & Time:*

☐ *Tick if you require COC to be emailed back* *Name:*

Signature:

Received at Hill Laboratories *Date & Time:*

Name:

Signature:

Condition *Temp:*

☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample & Analysis details checked

Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ Low ☑ Normal ☐ High

☐ **Urgent** (ASAP, *extra charge applies, please contact lab first*)

Requested Reporting Date:

Quoted Sample Types

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	SB09-0.0-0.15		Soil	Lead
2	SB10-0.0-0.15		"	
3	SB01-SB10 0.5 0.5		Soil	Hold / Cold
4				
5				
6				
7				
8				

ATTACHMENT E – MINISTRY FOR HEALTH GUIDANCE DOCUMENT

Minimising Lead Exposure in Shooting Club Ranges

Public Health Advice for Operators

The following recommendations are endorsed by the Auckland Regional Public Health Service (ARPHS) as part of best practice design and operation of indoor shooting ranges. There is no one-size-fits-all solution as every range is different and requires its own design solutions. The design concept of "dirty" areas and "clean" areas is useful. Please note that it is difficult to assess indoor shooting ranges for risks from lead exposure and to develop pragmatic, workable solutions. The regulatory agency for use of land and requirements related to buildings is the Territorial Authority for the location i.e. the local council. It is recommended that early consultation occurs with the relevant council to avoid expensive mistakes.

These recommendations also include safety advice for shooters. Shooting ranges and clubs should educate shooters about the potential harm of lead exposure and promote mitigation strategies via information pamphlets, club newsletters, email updates and website information. This document includes a reference list to many other sources of information.

Recommendations

Shooting Club Committees, Range Officers and Shooters at indoor shooting ranges should take the following steps to protect themselves from risks of elevated lead exposure:

When designing or renovating a shooting range - (to minimise lead exposure)

- Ensure adequate ventilation and air filtration systems are installed in consultation with an expert third party. Ventilation changes may need Council consent. **(1)**
- Where possible, use bullet traps that minimise lead dust generation. Some newer traps do away with the need for regular cleaning. Repeated misting with water using a garden sprayer will help to keep the dust down.
- In the "dirty" area, facility walls, ceilings, floors and all fixed structures, partitions, chairs and tables should have washable, smooth surfaces that are easy to keep clean.
- Avoid dust traps on ceiling beams or roof trusses and promote aerial separation of the "dirty" area from "clean" areas e.g. by self-closing, draught-proof doors.

Operating a shooting range - (to minimise lead exposure)

- Discourage eating, drinking or smoking in the firing range "dirty" area. **(2, 3, 4)**
- Ensure that shooters have ready access to hand washing facilities, and are advised to wash their hands immediately following their shooting session.
- Consider the use of lead free ammunition for indoor ranges.
- Consider limiting the number of shooters per session.

- Advise users to wear dust masks whilst shooting, to avoid exposure to excess lead. **(18, 19)**

Cleaning and maintenance of "dirty" areas

- Disposable overalls, gloves and masks should be worn at all times during cleaning. **(5)**
- Disposable overalls, gloves and masks should be worn during indoor repair and maintenance work. **(5)**
- Young persons of school age (defined as 15 and under) and women of childbearing age should not participate in cleaning or maintenance of "dirty" areas.
- Laminated posters on personal hygiene (especially on hand washing and not eating, drinking or smoking in the firing range) should be displayed prominently at ranges.
- A regular monitoring programme should be established to ensure the correct operation of ventilation systems with a written record kept of checks conducted. Ventilation systems need regular maintenance and cleaning (including filter replacement if required) according to manufacturers' advice. **(7, 8, 9 , 10, 11, 12)**
- Ensure fan and ventilation systems are always turned on and fully functional when the range is in use.
- Anyone participating in cleaning needs to have adequate training on ways to minimise lead dust exposure and in the use of appropriate personal protective equipment (PPE). **(7, 13)**
- A roster system should be created to rotate Range Officers and shooters to minimise lead exposure.
- Only use wet mopping or HEPA-filter vacuuming instead of dry sweeping when cleaning the floor in 'dirty areas'. Never dry sweep or use cleaning techniques that raise dust. **(5, 13)**
- When cleaning horizontal surfaces (other than the floor) in "dirty" areas, always use wet squeegees or wipes. **(5, 13)**
- If bullet traps needs to be emptied, debris should be emptied into sealed plastic bags and repeatedly misted with water to avoid raising dust.
- Contaminated materials (i.e. wiping cloths, filters, mop heads and contaminated back stops/soil etc.) should be safely disposed to landfill by a Department of Labour approved cleaning contractor - as hazardous material.
- If contractors are hired to clean premises or remove lead contaminated back stops/soil, then they must follow best practice guidelines i.e. Department of Labour rules and Territorial Authority rules.

Information for shooters

Shooters regularly attending an indoor shooting range; shooters who cast their own bullets and shooters who are involved in regular range housekeeping or maintenance activities should consider asking their GP to monitor their blood lead level. These persons may have raised levels of lead in their blood, where indoor shooting could be a contributing lead exposure risk. **(14, 16, 17)**

Environmental management

- Shooting range management should also consider how to dispose of waste that contains lead residues to minimise the impact of lead pollution on the environment.
- Ranges and clubs should nominate a health and safety representative, often the Range Officer, who is trained to minimise lead exposure and tasked to actively raise awareness amongst shooters of ways to decrease lead exposure. For example, they could initiate the production of advice, policies, procedures, and programmes specific to indoor shooting ranges according to relevant standards and legislation.
- Shooters should use personal protective equipment (PPE) and consider regular blood tests to check their lead levels. **(14, 15)**
- Clubs should advise shooters to consult a doctor if concerned about their health. ARPHS will contact members with raised blood lead levels and discuss how lead exposures may be reduced.
- Lead exposure resulting from work activities is a matter for the Department of Labour (DoL). **(16,17)**

Should you require any further information about dealing with environmental exposure to lead, please contact the duty Health Protection Officer (Environmental Health) at ARPHS ph: 09 623 4600.

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Last reviewed November 2018

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New Zealand Government

The Environmental Case Management of Lead-exposed Persons

Guidelines for Public Health Units

Revised March 2021

These guidelines are dedicated to John Feltham
CEng MICE MIMechE MIPENZ RegEng
(1931–1997) who made such a significant contribution
to improving environmental health in New Zealand.

Citation: Ministry of Health. 2021. *The Environmental Case Management of Lead-exposed Persons: Guidelines for Public Health Units: Revised 2021.* Wellington: Ministry of Health.

Published in March 2021 by the Ministry of Health
PO Box 5013, Wellington 6140, New Zealand

ISBN 978-1-99-002998-1 (online)
HP 7614

This document is available at health.govt.nz

Preface

There is a continued awareness about the hazards associated with lead and the risks, particularly to children, created by exposure to lead from various sources where young children gather and play. Exposure can occur in early childhood education centres and playgrounds, but it is especially likely in the home.

Families in older homes are at risk when lead-based paint is being removed or when it deteriorates (becomes flaky or powdery) and falls off. Soil and dust contaminated with lead in this way become pathways of exposure. There have been cases of children being fatally poisoned as a result of chewing or swallowing lead-based paintwork. Young children are most at risk because of their habit of placing things in their mouths, ingestion of non-food substances (pica), and greater absorption of the lead they take in than older children and adults. Adults may also be at risk from non-occupational exposures due to paint removal, and hobbies particularly, indoor rifle shooting.

Lead absorption is a condition which is notifiable to the medical officer of health under the Health Act 1956 and the Hazardous Substances and New Organisms Act 1996. The levels of blood lead which are required to be notified in New Zealand under the Health Act 1956 are 'lead absorption equal to or in excess of 0.24 µmol/l (5 µg/dl)'.

Notification is not an accurate reflection of the problem. Many cases go undetected as the individuals are generally asymptomatic until the blood lead level is at least six times the notifiable level.

These guidelines are intended to be a resource document for public health units who will be involved in the investigation and management of people who have been exposed to lead.

While the guidelines are applicable for any age, there is an emphasis on measures for managing cases of lead-exposed children. Originally published in 1998 after field testing of interim guidelines for a year and redrafting, these guidelines have been periodically updated to take account of new developments in New Zealand and internationally with respect to management of lead exposure.

Contents

Introduction

Background

These guidelines provide practical advice for the investigation and environmental case management of lead-exposed cases. They are intended to assist public health teams achieve a tolerable level of lead in the environment for exposed children or adults, so limiting any adverse effect on their health. Making their environment 'lead safe' will also protect people who might otherwise be exposed to the same lead hazards in the future. Although the guidelines focus on secondary prevention, increasing evidence of the toxicity of lead at levels previously regarded as harmless strengthens the importance of primary prevention (CDC 2012, ATSDR 2020).

Although blood lead levels in the population have reduced considerably in the last few decades, primarily due to the removal of lead from paint and petrol, they remain higher than in the pre-industrial era.

Purpose of the guidelines

The guidelines provide guidance to public health units on the management of risks to health from exposure to lead in non-occupational settings. Properly applied, the guidelines will assist with determining:

- the risk of a lead hazard
- appropriate advice on managing the risk, including risk communication.

The guidelines will normally be used in the context of 'secondary prevention' when a person is, or is suspected to be, exposed to lead. The guidelines are not intended for primary prevention of hazards arising from lead (eg, inspection, risk assessment and risk reduction from lead in dwellings regardless of a resident's blood lead levels), although many of the basic procedures, sampling and abatement methods would be similar.

While lead-based paint sources will frequently be implicated, the investigation of lead-exposed people should evaluate the contribution of all potential sources to the overall lead exposure. Sources other than lead-based paint include lead transported home on work clothes, hobbies involving lead (eg, lead lighting, graphic materials, indoor rifle shooting[1]), lead-based cosmetics and traditional medicines (eg, Ayurvedic remedies), leaded pottery and ceramic glazes, and lead in food and drinking water.

These guidelines assist public health staff to identify all contributory lead hazards and (open) exposure pathways using a combination of interview, visual observation, and laboratory testing. A management plan, typically incorporating both behavioural (educational) and environmental (abatement) strategies, can then be developed in

[1] Further information for shooters is provided in Appendices 5 and 6.

consultation with the household of the affected person. It must be emphasised that the guidelines aim to provide a relatively 'lead-safe' environment, which is not the same as a lead-free environment.

Exclusions

These guidelines exclude places of work because these are covered by the Health and Safety at Work Act 2015 (HSWA). WorkSafe New Zealand (WorkSafe) is responsible for enforcing the Health and Safety at Work Act 2015. The home, public buildings, and schools may be places of work if contractors are doing work in them.

Ambient (outside) air is covered by the Resource Management Act 1991 (RMA). The Ministry for the Environment administers the RMA, and the RMA is implemented by regional councils in so far as it relates to the discharge of contaminants to air. Lead may also occur in ambient air from diffuse sources, but such sources are not considered within the scope of these guidelines. For example, prior to the removal of lead from petrol, vehicle emissions were a significant source of lead in the environment. Ambient air inside dwellings and point source release of lead around dwellings would be covered by these guidelines.

Chapter 1: Hazard identification

Main points

- Lead-based paint is almost certain to be present on pre-1945 paintwork and is likely to be present on pre-1980 paintwork.
- The US Environmental Protection Agency's hazard standards (USEPA 2019) may be used as a guide:
    - floors (including carpeted floors) >110 µg/m^2
    - interior window sills >1080 µg/m^2
- Lead contamination of soil around residential properties occurs mainly as a result of deterioration, damage or removal of exterior lead-based paintwork.
- The contribution of soil lead to total cumulative lead exposure is highly variable, depending on such things as the content and bioavailability of lead in the soil and the behaviour of people in the household, particularly children.
- The soil contaminant standards (SCS) in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health are based on people being routinely exposed to bare soil and consuming home-grown produce, where applicable.
- The SCS of 210 µg/g can be considered as a 'level of concern' for a residential setting and is recommended as a trigger for investigation.
- There is evidence to suggest that soil removal and replacement may not be worthwhile as an abatement strategy at soil lead levels less than 3000 µg/g, but a more stringent standard, 210 µg/g, is likely to be appropriate for sandpit sand or other high-contact areas for young children.

Lead in paint

Introduction

Lead has been used in paint since ancient times, as a pigment and as a drying agent in oil-based paints. The concentration of lead in domestic paints declined dramatically over the latter half of the last century. It may be assumed that pre-1945 interior or exterior domestic paintwork contains a high lead content; pre-1965 paintwork probably does, while pre-1980 paintwork possibly does. Post-1980 paintwork may generally be assumed

to have a very low lead content, unless old stock or industrial specification paint was used (inappropriately).

The list below shows key dates and events in the use of lead in paint in New Zealand.

- Before 1945, white lead (lead carbonate) was extensively used as a pigment in paint, especially exterior house paint (which contained up to 50 percent lead by weight in the dry film) and as a masonry filler mixed with gold size. White lead was progressively replaced by titanium dioxide in domestic paint.
- White lead and lead sulphate were finally banned from paints intended for domestic use in 1965.
- Lead chromate (bright yellows, oranges and reds generally in top coats) remained in use as an ingredient in domestic paints (for interior and exterior use) until the late 1970s, and possibly until the 1990s by some small suppliers of paint, and is still used for automotive and some heavy duty maintenance paints.
- Red lead was extensively used as a steel primer and was also in wood primers until the late 1970s to early 1980s. Old coats of a primer that appears pink, however, do not always contain red lead, as other pink pigments were and still are used. Some steel-sash putty used to be made up from red lead powder and linseed oil putty; it is unlikely to be found in wooden windows.
- Calcium plumbate was widely used in primers for galvanised steel roofing from its introduction in 1958 until the 1990s. It is no longer manufactured.

Lead-based paint hazards

Lead-based paint will be found on exterior painted surfaces that were constructed or painted prior to 1945, and with reducing probability of it being present as white lead up to 1965. Red lead and lead chromate paints may be found up to the early 1980s (lead chromate possibly later). Calcium plumbate paint (galvanised iron primer) may be found on roofs from 1958 to the mid-1990s. All external surfaces may be affected such as cladding, doors and jambs, windows, painted decking, guttering, downpipes, stairs, railings, outbuildings, fences, and outdoor play equipment.

Interior surfaces constructed or painted before the dates given above may also contain appreciable quantities of lead. Lead-based or lead-containing paint may be present on fixtures and fittings, and building components such as doors and jambs, skirtings, stairs, painted areas of floors, windows and frames. Furniture such as wooden or metal cot railings and children's old toys may also contain lead-based paint. Window putty (particularly in steel windows) may be an additional source.

While a lead-containing paint film is intact, it presents no hazard (other than when direct biting or chewing occurs, which by definition damages the surface), whether or not it is overcoated by a lead-free surface layer. The identification or removal of intact lead-based paint is not the purpose of case management. Instead, investigation of a lead-exposed case should focus on the identification and characterisation of lead-based paint hazards.

A lead-containing paint film becomes hazardous when:

- paintwork is in an advanced state of deterioration (ie, powdering, chalking, blistering, peeling or flaking) and generates small particles that contaminate adjacent soil or become part of interior settled house dust
- paintwork is continually or repeatedly scratched, scraped, rubbed or otherwise worn (ie, friction or impact surfaces such as sash windows, incorrectly hung doors, painted stairs or floors), so it generates lead-bearing dust
- paintwork is being removed (ie, artificially damaged) using an inappropriate method (such as power sanding, abrasive blasting, or open flame burning) that again generates dusts or fumes. This includes lead paint that is covered by a layer of non-leaded paint
- paintwork was in the past removed using such unsafe renovation practices, resulting in (extensive) contamination of soil, exterior dust, dust in spaces such as wall cavities, under-floor, roof or ceiling space, and interior settled house dust
- paintwork is in a situation or condition where it may be mouthed, chewed, or eaten (typically this refers to chewable surfaces such as window ledges).

Note that these conditions may create a hazard even when lead-based paint is not the surface layer but is covered by layers of unleaded paint: the full thickness of any multi-layered paint coating must be considered when assessing for hazard.

Identification of lead-based paint hazards therefore requires knowledge of the age of the painted surface (or use of a field test for lead in paint), the past history of (re)painting of the surface, and the condition of the paint on the surface. Paint condition can be assessed in terms of:

- visible bite marks (on a chewable surface)
- evidence of wearing (on a friction or impact surface)
- evidence of powdering, chalking, peeling or flaking (ie, natural deterioration)
- evidence of (past or current) unsafe paint removal (ie, artificial damage).

Standards and extent of potential hazard

Group standards are issued in accordance with the requirements of Part 6A of the Hazardous Substances and New Organisms Act 1996 (HSNO Act). The Group Standards for Surface Coatings and Colourants place restrictions on the lead content and how lead-containing paints can be used in New Zealand. These restrictions prohibit the manufacture, sale, supply or use of paints containing lead carbonate (white lead) except for application as a mirror backing when the paint contains no more than 15 percent of lead in the non-volatile content of the paint.

The Group Standards for Surface Coatings and Colourants also prohibits the manufacture, sale, supply or use of any paint with greater than 0.1% of lead or lead compounds, or greater than 0.2% of lead or lead compounds occurring as an impurity in zinc-based paints for application to:

- a roof or for any surface to be used for the collection or storage of potable water
- furniture
- any fence, wall, post, gate, building (interior or exterior), bridge, pylon, pipeline, storage tank or any similar structure
- any premises used for the manufacture, processing, preparation, packing or serving of products intended for human or animal consumption.

Also, under the Group Standards for Surface Coatings and Colourants it is prohibited to manufacture, sell, supply or use a paint for application to toys unless the paint complies with the specification for coating materials contained in Australian/New Zealand Standard AS/NZS ISO 8124.3:2012 *Safety of toys Part 3: Migration of certain elements*.

Lead in house dust

Introduction

Ingestion of leaded surface dust (settled dust) is the major way young children are exposed to lead. Accessible dust contaminates the child's hands during play and is transferred to the mouth via hand-to-mouth activities such as thumb sucking and nail-biting. Some toys that children may put in their mouths may also be contaminated.

Sources of lead in house dust include lead-based paint, occupational take-home lead, and lead-based hobbies. Lead in petrol was previously also a source. Lead in air results decreased following the introduction of unleaded 91 octane petrol in 1987 (Narsey and Stevenson 1997). Leaded 96 octane petrol was phased out in New Zealand in 1996.

Paint is by far the major source of lead. Leaded dust is generated when lead-based paint:

- deteriorates over time
- is damaged by moisture
- is abraded by friction and impact
- is disturbed in the course of repainting (renovation) or abatement.

Interior lead-based paint contributes directly to house dust lead, while exterior painted surfaces contribute indirectly via soil lead.

Lead in soil derives also from the deposition of lead in air (from stationary sources) and natural sources. Soil particles may be picked up again by wind and carried into the dwelling by wind transport or building ventilation. Alternatively, leaded soil particles may be tracked into the house on shoes or pets. In either case, these particles become components of the house dust.

The rate of deposition and lead content of house dust will therefore be determined by the:

- lead content of paint (correlated with age of the property)
- extent of painted surfaces
- location of painted surfaces (whether exterior or interior)
- condition of paint (whether naturally deteriorated or artificially disturbed)
- extent and type of soil around house and neighbouring properties
- history of external paint removal and hence the degree of soil contamination
- nature of ground cover (particularly location of bare soil areas in relation to painted surfaces)
- distance of property from stationary sources
- magnitude and direction of prevailing winds (and type of building ventilation)
- extent of soil tracking (by people and pets)
- residents' occupations and hobbies.

Bioavailability

The bioavailability of lead in house dust varies with:

- metal species
- particle size distribution
- matrix effects.

Within the living space of the home it is only lead in dust that is directly accessible to the case that creates the hazard. However, dust accumulations in the wall cavities, underfloor space, roof space and ceiling space will contribute to interior dust to the extent that these spaces are not sealed off from the living space. Because the lead content of these dusts may be high (reflecting their origin), their contribution to house dust dynamics needs to be recognised. Rates of deposition and removal of dust in the home will vary between locations and over time, as will the lead content of incoming dust and the thoroughness of cleaning.

Carpets and soft furnishings act as 'dust traps'. Bioavailability of lead in carpet dust may be low. Smaller and heavier particles move deeper within the carpet, making these particles less accessible (carpet beating may be hazardous for this reason).

Vacuuming without a high-efficiency particulate air (HEPA) filter on the exhaust outlet of the cleaner re-suspends very fine, invisible leaded dust particles, which may subsequently settle in more accessible locations. Effective dust control therefore requires use of a vacuum cleaner fitted with a HEPA filter. (Refer to *Vacuuming*, in Chapter 5, for further details.)

Children's behaviour patterns are not static and vary with age. The time spent playing or hiding in different 'micro-environments' (rooms or cupboards) and the activities carried out in these locations will also determine exposure to accessible dust accumulations.

Dust lead loading

Lead exposure via the dust pathway is determined by both the lead content (concentration) of the dust and the amount of dust available (dust loading); that is, the important exposure variable is dust lead loading (µg lead/m^2 of dust-bearing surface) rather than dust lead concentration (mg lead/mg dust).

Dust lead loading is a better predictor of children's blood lead levels than is dust lead concentration (Lanphear et al 1994). Furthermore, while abatement interventions would be expected to have some effect on the lead content of house dust (by removing or reducing the intensity of the source, so that lead-rich dust becomes diluted over time with lead-poor dust), their major impact will be on the net amount of dust accumulating, and therefore on dust lead loading.

Monitoring of dust lead loading requires careful attention to the accurate measurement of the surface area sampled, and to timing sample collection consistently in relation to the time at which the collecting surface was last cleaned.

Dust lead standards

Background levels

A 'typical' background value or range for dust lead loading is unrealistic to cite as it is influenced by many variables. These include the:

- lead content of soil and transfer rates of soil particles to dusts in various locations
- lead content of dusts in underfloor and related spaces and transfer rates of dusts between these spaces and the living space
- lead content and deposition rates of interior dusts
- location of the sampling site in relation to lead-based paint hazards
- exterior dust contributions, surface texture, and cleaning routines.

US EPA dust standards

The US EPA has two dust lead hazard standards for floors and interior window sills. Hazard standards for dust were developed by correlating lead in the environment to blood lead concentrations (revised in 2019).

The standards are summarised below, converted to metric measurement and rounded to the nearest 10 µg/m^2 for ease of use:

1. Hazard standards (USEPA 2019)
   - Floors (including carpeted floors) >110 µg/m^2
   - Interior window sills >1080 µg/m^2

   The dust lead hazard standard for floors and for interior window sills is based on a weighted average of all wipe samples.

2. Proposed clearance standards (USEPA 2020)

- Floors (including carpeted floors) 110 µg/m^2
- Interior window sills 1080 µg/m^2

Clearance standards are the maximum amount of lead permitted in surface dust after abatement. These proposed standards have been updated to take account of health risks at lower blood lead levels than recognised when they were originally set in 2001.

These standards should be used as a guide only, particularly if they are applied to soft furnishings.

Lead in soil

Sources of lead in soil

Contamination of soil with lead particles results from deterioration, unsafe removal, or damage to exterior lead-based paintwork; historic use of leaded petrol and (less commonly in New Zealand) stationary sources such as used lead battery collection facilities. Another source may be lead heads off roofing nails, which may find their way into soils after being reduced to fine particles by lawnmower blades.

Lead-based paint hazards typically generate hot-spots of high soil lead concentration within 1 or 2 metres of the painted surface. The past dumping or burning of building debris contaminated by lead-based paint, or the disposal of ash from fires (including indoor fires) may produce hot-spots of high soil lead at a distance from the house. There may be gross contamination of soil, with visible paint flakes and chips, particularly if paint removal has been attempted using unsafe methods.

Exterior dusts, such as street dusts and dust accumulations on paved surfaces (patios, pathways, pavements), may also be contaminated with lead from the same sources.

Deposition of lead particles onto the soil surface is followed by binding to the soil matrix, limiting the metal's mobility to less than 5 cm of soil depth. The extent of binding depends on the soil type (especially organic content) and pH of the soil water.

This does not mean, however, that only the top 5 cm of soil may contain lead. As new soil layers build up on top of older layers, a lead-rich layer (resulting, for example, from a period of house renovation) may sometimes become buried by a lead-poor layer, reversing the usual decreasing gradient of lead in soil with depth. This implies that core samples should be checked if soil removal is being considered as an abatement strategy.

Soil particles rich in lead that are located near the surface may directly contaminate the hands of children and be ingested through normal repetitive hand-to-mouth activity. Soil may also be deliberately eaten by children with pica.

Surface soil particles may also be blown about by wind or may adhere to footwear, toys or pets, and so end up in the interior living space (directly or through an intermediate reservoir such as underfloor or roof space dust), so contributing to interior settled house dust.

The contribution of soil lead to total cumulative lead exposure is highly variable, and is influenced by the:

- lead content of the soil (and profile of lead concentration with depth)
- bioavailability of lead in soil (determined by chemistry and geology of the soil, metal species, and particle size distribution)
- nature, extent and continuity of the ground cover (bare soil is more readily entrained by wind, more likely to adhere to footwear, toys or pets, more likely to contaminate children's hands, and more available to be eaten by a child with pica. A soft cover such as grass or bark chips can reduce exposure by up to 80 percent, and a hard cover such as paving is even more effective)
- physical geography of the site (location of bare soil areas in relation to lead-based paint hazards, principal play areas, pathways, and house entrances)
- meteorological conditions including strength and direction of prevailing winds (in relation to building ventilation)
- transfer rates between soil – exterior dust – underfloor/roof space dust – interior house dust
- behaviour of people and pets.

Standards for lead in soil

Background levels

There is a wide range in reported 'background' levels for lead in New Zealand soils, ranging from 20 µg/g (ppm) in pristine rural soils to over 200 µg/g in older urban neighbourhoods.

Soil lead and blood lead

Weitzman et al (1993) carried out studies in Boston of the effects on blood lead of various abatement interventions with the objective of determining the independent effect on blood lead from reductions of lead in soil accessible to children. Soil contaminated to a median surface lead level of 2075 µg/g was removed and replaced. The average drop in soil lead levels was 1790 µg/g and was accompanied by a decline (after 11 months) independently associated with soil abatement, ranging from 0.8 to 1.6 µg/dl when confounders such as water, dust and paint lead levels, children's behaviours and other characteristics were controlled for. The curve gives a similar reduction in blood lead over the same range of soil lead. This implies that soil removal and replacement may not be worthwhile as an abatement strategy at soil lead levels less than 3000 µg/g.

Lanphear et al (2003) found, after adjustment for confounders, residential soil removal and replacement at levels above 500 µg/g led to a 2.5 µg/dl decline in blood lead among children aged six months to three years. There was an estimated 3.5 (95% CI 2.4–4.6) µg/dl reduction in blood lead level among this age group for every 1000 µg/g reduction in soil lead. No significant reduction in blood lead level was found for children aged three to six years.

Studies by Weitzman et al (1993) and Lanphear et al (2003) for soil lead levels in the range of 1000 to 3000 µg/g, suggest soil removal is probably not indicated, and measures such as improving ground cover and behaviour modification (eg, relocating the principal play area away from the house) may suffice. At soil lead levels less than 1000 µg/g bare soil areas should still be covered (a soft cover such as grass or bark chips is generally adequate), if indicated by use pattern analysis, as soil lead tracked or blown into the house will be contributing to dust lead in the home.

Soil Contaminant Standards (SCSs)

The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES) provides the SCS for lead in soil. The SCSs have regulatory status under the NES and act as trigger for resource consent requirements. Existing uses are not affected by the regulation. The NES only applies at the time of subdivision, land use change, major soil disturbance, soil sampling or removal of fuel storage systems.

These values are risk based and were derived from the most up to date toxicological and epidemiological information. The focus of the NES is to ensure that human health is protected from the adverse effects of certain hazardous substances in the soil. The SCS is conservative compared with other jurisdictions' soil guideline values as it was based on the Joint Food and Agriculture Organization of the United Nations/World Health Organization's Expert Committee on Food Additives' (JECFA) conclusion to withdraw the potential tolerable weekly intake (PTWI) of 25 µg/kg body weight as it could no longer be considered health protective (JECFA 2011).

The PTWI of 25 µg/kg body weight for lead is associated with a decrease of at least three IQ points in children and an increase in systolic blood pressure of approximately 3 mmHg (0.4 kPa) in adults. While such effects may be insignificant at the individual level, these changes are important when viewed as a shift in the distribution of IQ or blood pressure within a population. As the dose response analyses do not provide any indication of a threshold for the key adverse health effects of lead, JECFA concluded that it was not possible to establish a new PTWI that would be health protective.

In cases of a non-pica child who may play outside on a high contact area, soil abatement by improving ground cover (eg, grass, bark chips) and behaviour modification (eg, relocating the principal play area away from the house) may suffice in most cases. A stricter standard of 210 µg/g is likely to be appropriate for a small high-contact area such as a sand pit (given its uncovered nature and pattern of activities associated with it).

Stricter standards would also be appropriate for families with a pica child. Careful questioning of caregivers and time spent directly observing child behaviour is valuable when it comes to assessing the health risk from elevated soil lead levels.

The summary of SCSs for inorganic lead is shown below.

Lead levels – soil contaminant standards	µg/g
Rural residential/lifestyle block 25% produce	160
Residential 10% produce	210
High-density residential	500
Recreational	880
Commercial/industrial (outdoor worker or unpaved)	3,300

Lead in water

Sources of lead in water

There is potential for elevated lead levels in drinking-water from dissolution of lead pipes and solders, and brass fittings in homes. Leaching of lead from newly fitted uPVC pipes has been overcome by the introduction of a New Zealand standard.

The amount of lead dissolved is dependent on, amongst other things, pH, temperature, stagnation time and water hardness.

An assessment of the levels and sources of lead in school drinking-water in New Zealand showed that neither industrial nor vehicular air pollution by lead-containing compounds were considered to be significant contributors to lead levels in drinking-water (Ministry of Health 1996). The lead appeared to have entered the supply through dissolution from the reticulation and/or in the case of roof catchment from components of the rainwater collection system, such as lead-head nails, lead flashings and lead soldered storage tanks.

The lead levels in many of the first flush water samples taken from systems terminations had significantly higher lead levels than those of the second flush samples. This suggested that lead levels originate not from the rain water collection system, but rather from the reticulation.

Levels at drinking fountains were generally higher than those taken elsewhere in the reticulation. The long runs of reticulation to the drinking fountain was considered a contributory factor in the higher lead levels. The softness of rainwater and plumbosolvency of the catchment and distribution systems are critical contributing factors to elevated lead levels.

Standards for lead in water

The New Zealand Drinking-Water Standards 2005 (revised 2018) provide a maximum acceptable value (MAV) of 0.01 mg/l for lead. While first draw water (ie, taking directly from the tap without flushing) may sometimes contain lead in excess of this concentration, in almost all cases flushing a mugful of water from drinking water taps each morning will reduce its concentration to less than 50 percent of the MAV because the primary sources in most dwellings is the brass of the tap or associated fittings.

Chapter 2: Dose response, exposure assessment, risk characterisation and risk communication

Main points

- Determine exposure pathways.
- Identify the lead-based paint hazard, such as visible bite marks, evidence of wearing, evidence of powdering, chalking, peeling or flaking, or evidence of unsafe paint removal.
- Dust is the major pathway of exposure to lead for children, and lead-based paint is the major source of this lead.
- Dust lead loading (expressed as $\mu g/m^2$ of dust-bearing surface) is the most important exposure variable.
- The amount of lead ingested and absorbed by children depends on dust lead loading, child behaviour, and bioavailability of lead in house dust.
- About 25 percent of two-year-old children display some degree of pica behaviour. A two-year-old can ingest approximately 100 mg of soil per day through hand-to-mouth activity.

Health effects

Lead is a persistent environmental pollutant, and it is widely distributed throughout the built and natural environment. It causes a variety of symptoms, some of which are indistinguishable from other causes, and may ultimately result in death. The most well-studied health outcomes are neurological, renal, cardiovascular, haematological, immunological, reproductive, and developmental effects. Neurological effects of lead are of greatest concern (ATSDR 2020). Lead affects the developing brain and nervous system and can result in impaired cognitive and neurobehavioural development of children.

The uptake of lead in the non-occupational environment is predominantly from dust or fume inhalation, and the ingestion of paint fragments or dust (directly or via contaminated food stuffs). The primary route of uptake among children is ingestion, particularly among preschool children, who tend to eat, chew, lick or suck non-food items (including contaminated fingers). Seasonal variations in blood lead levels in children have been found, with a general trend of increasing concentrations during late summer and early autumn (ATSDR 2020).

Adults tend to inhale lead, typically as dust arising from domestic cleaning and renovation activities, or fumes from firing a firearm. Poor personal hygiene before smoking or eating may also result in appreciable ingestion where hands are contaminated from activities eg, paint removal or indoor rifle shooting.

Once in the body, lead may pass into the bloodstream or be excreted via faeces and urine. The rate of uptake depends upon many factors, not least the chemical and physical form of lead and nutritional status. Once in the bloodstream, lead tends to accumulate rapidly in hard tissues such as bones and teeth, from which it may be slowly released back into the bloodstream. Up to 90 percent of body lead burden may be found in bones.

The rate of release is largely governed by blood lead concentration relative to that of the accumulation sites. When the uptake rate exceeds the excretion rate, there is a net accumulation of lead in the body and symptoms of lead toxicity will ultimately occur.

Health effects are the same irrespective of the route of exposure. The early stages of lead toxicity are non-specific and affect the haematopoietic, gastrointestinal and nervous systems. Genetic predisposition can also affect vulnerability to lead-induced neurotoxicity. In later stages, symptoms may develop in the blood, kidneys, bones, heart and reproductive systems and may, in extreme cases, cause death. One of the most important manifestations of lead exposure is developmental impairment in children.

Symptoms of lead toxicity involving the nervous system can include:

- mood changes such as depression or irritability
- memory impairment
- sleep disturbance
- concentration difficulties
- headaches
- tingling and numbness in fingers and hands
- muscle weakness and wrist drop (heaviness of limbs)
- fits (rarely).

Symptoms of lead toxicity involving the gastrointestinal system can include:

- lack of appetite
- nausea
- diarrhoea
- constipation
- stomach pains

- weight loss.

Other effects may include:

- kidney damage and increased blood pressure
- decrease in numbers and quality of sperm
- miscarriage
- anaemia.

Although clinical symptoms of lead toxicity generally become apparent at blood lead concentrations above 3.38 µmol/l, cognitive deficits have been observed in children at blood lead levels previously thought to be harmless, with effects now recognised below 0.24 µmol/l (ATSDR 2020). In addition, most children suffering from elevated blood lead levels are asymptomatic or have non-specific symptoms.

Whilst a number of effects have been seen at blood lead levels below 0.24 µmol/l, the evidence is strongest for cognitive deficits in children (ATSDR 2020). Systematic reviews have concluded that blood lead levels below 0.48 µmol/l are associated with several adverse health effects (National Toxicology Program 2012; US EPA 2013; National Health and Medical Research Council 2015). Among the health effects that are associated with levels below 0.48 µmol/l are:

- decreased IQ and academic achievement in children
- adverse behavioural effects (attention, impulsivity and hyperactivity) in children
- delayed sexual maturity or puberty onset in adolescents
- increased blood pressure and risk of hypertension among adults and pregnant women.

The National Toxicology Program systematic review (2012) of epidemiological literature concluded that there was sufficient evidence of an association between health effects and low-level lead exposure. The US Environmental Protection Agency systematic review (2013) of published studies concluded that the relationship was causal. Armstrong et al (2014) who reviewed these systematic reviews, along with human epidemiological studies on the health effects of blood lead levels less than 0.48 µmol/l (published from 2004 – mid-May 2013) disagreed with the conclusions of the two systematic reviews. Armstrong et al instead claim that the evidence was suggestive rather than definitive of an association as the human evidence was from observational studies.

Several studies have suggested that the exposure-response to lead is non-linear, and that for a given increase in blood lead, the associated decrease in IQ and academic achievement is greater at blood lead levels below 0.48 µmol/l than at higher levels (Canfield et al 2003; Bellinger and Needleman 2003; Lanphear et al 2005; Crump et al 2013; Evens et al 2015). In contrast, the evidence for an association between prenatal lead exposure and child IQ is inconsistent (Taylor et al 2017). A longitudinal study found a stronger relationship between blood lead concentration and IQ at ages five and seven years despite lower blood lead concentrations at these ages than when they were two years. This suggests that a child's blood lead level until school age and not the peak level which typically occurs at two years is important for optimum cognitive development (Chen et al 2005).

Effects of childhood lead exposure on cognitive development appear to be irreversible (Tong et al 1998; Reuben et al 2017). Follow up of the Dunedin Multidisciplinary Health and

Development Study cohort at age 38 found childhood lead exposure was significantly associated with lower adult IQ and socioeconomic status, after adjusting for childhood IQ, maternal IQ and childhood socioeconomic status (Reuben et al 2017).

Although effects of low lead levels are not likely to be recognisable or measurable in an individual child, they are important on a population basis. Relatively small changes in the average IQ of many children increases the proportion below any IQ level of concern at which additional educational assistance may be required and decreases the proportion above any 'gifted' level.

The general state of health may influence the severity of symptoms, as lead already in the body may be mobilised during pregnancy, menopause or ill-health, or due to excessive alcohol consumption. Lead can cross the placental barrier and affect an unborn child.

The intensity of exposure may vary greatly, and the effects of exposure may thus be acute (resulting from short-term, intense exposure) or chronic (resulting from prolonged low-intensity exposure).

As lead is a bioaccumulative toxin, prolonged exposure to a low level of contamination can lead to appreciable concentration in the body over time.

A meta-analysis of 31 studies found a weak association between blood pressure and blood lead level. A twofold increase in blood lead level was associated with a 1.0 mm Hg rise in systolic pressure and 0.6 mm Hg increase in diastolic pressure (Nawrot and Staessen 2006).

The International Agency for Research on Cancer (IARC) has classified inorganic lead compounds as probably carcinogenic to humans (Group 2A) while organic lead compounds are not classifiable as to their carcinogenicity to humans (Group 3) (IARC 2007).

Exposure assessment

Knowledge of exposure is essential for environmental epidemiology and hazard control. The measurement of exposure to lead can be determined by absorbed dose. The sources of exposure can be determined by exposure characterisation using questionnaires, interviews, inspections, historical records, and/or exposure simulations.

Lead paint exposure pathways

Lead-based paint is generally the major source of both lead in soil and lead in house dust. These are typically the more important pathways of exposure, particularly the latter, due to the greater bioavailability of small particle lead. However, the relative contributions of direct consumption of paint, soil ingestion, and ingestion of house dust, to blood lead will vary with the situation, depending on both environmental and behavioural factors.

Paint may be directly consumed by children, particularly if it is flaking or peeling. Lead paint has a sweet taste and is attractive to children, whether or not they have a general

tendency to consume non-food items such as soil (ie, pica). Children may also chew or bite into (previously) intact painted surfaces, so damaging these surfaces and ingesting paint. Window sills (ledges), doors, cot railings, and toys are typically preferred for chewing or biting.

Adults involved in paint removal inhale lead directly from paint dust or ingest it if they have not washed their hands before smoking or eating.

Cumulative exposure via house dust

Adults who may be exposed to hazardous amounts of dust include:

- those involved in paint removal operations
- those living where dust residues contain high lead levels arising from historical or ongoing paint removal operations
- those whose hobbies expose them to other sources of lead, particularly firearms users.

Dust lead loading, behaviour, and bioavailability of lead in house dust interact to determine cumulative absorption of lead from house dust. The factors influencing these variables, and potentially controllable by environmental and behavioural intervention strategies, may be summarised as follows:

1. time spent by the person in different microenvironments (rooms, cupboards)
2. activities of the person in each microenvironment (extent of hand contamination and hand-to-mouth transfer)
3. household activity, for example, cleaning methods which extract dust from carpets or other surfaces and may increase the deposition rate
4. lead concentration of the dust in each microenvironment
5. dust loading in each microenvironment (ie, net dust accumulation, determined by the difference between deposition rate and removal rate)
    - deposition rate is determined by the location of sources and ventilation pattern
    - removal rate is determined by the surface texture and cleaning routine
    - the product of 3 and 4 is the dust lead loading
6. bioavailable fraction (influenced by chemical species, particle size distribution, matrix effects, and physiological and genetic factors influencing gut absorption).

Pathways of exposure to lead in soil

Soil ingestion

Children are most at risk of soil ingestion, mainly from outdoor play. Several studies have shown a correlation between hours spent playing outdoors and blood lead level, especially for preschool children.

Exposure results from normal play activity, leading to hands getting 'dirty' followed by hand-to-mouth activity (thumb sucking, nail biting) or eating without washing hands. Food may also be eaten after falling onto the ground. Toys and similar objects may be mouthed after coming into contact with soil, or act as vehicles for transfer of leaded particles from soil to hands.

It has been estimated that a two-year-old ingests approximately 100 mg of soil per day through such activities, with younger and older children ingesting less.

The key factors influencing exposure from playing outdoors are:

- soil lead concentration and bioavailability
- ground cover
- use patterns (time spent in different outdoor microenvironments, play activities, pica behaviour).

Pica

It is believed that up to a quarter of two-year-old children display some degree of pica behaviour (eating of non-food items including soil), although in only a minority is this behaviour marked. Pica is less common in children both younger and older than two years. In some cases, pica is associated with iron deficiency or cognitive or behavioural problems, but often there is no obvious cause.

A pica child may ingest significant amounts of lead from soil that is near or even below guideline levels. The child may also target 'hot spots' where there is a localised elevated level of lead in the soil.

Any degree of pica places the child at increased risk of lead exposure (from soil) and should be taken seriously. Careful questioning and direct observation may be required to identify and evaluate pica behaviour.

Home-grown vegetables

Because of its limited mobility in soil, little lead is absorbed through the roots of plants. However, soil on harvested root crops may be ingested, if not fully washed off before eating.

In addition, fallout of lead in air may directly contaminate leaves and other above-ground parts of plants; broad leafy vegetables are most likely to be affected.

Home-grown vegetables may therefore make a contribution to dietary lead intake, albeit usually a minor one. Vegetable gardens planted close to major lead-based paint hazards should receive attention. Gardens remote from current lead hazards may also be contaminated from prior use of the site or windblown dusts and may also need assessment on occasion.

Dust ingestion

Soil particles are one of the components of house dust. Except for the pica child, house dust is likely to be the major route of most people's exposure to soil lead.

The relative contribution of soil and other routes to the 'final common pathway' of interior settled house dust exposure varies, depending on:

- lead content of the soil
- transfer rate of particles between soil and house dust (directly and via such intermediate reservoirs as underfloor and roof space dusts)
- contribution from interior sources.

Risk characterisation

Risk characterisation combines the information obtained from the hazard identification, dose-response assessment, and exposure assessment to estimate the risk associated with each exposure scenario considered, and to present uncertainties in the analysis.

Notification of 'lead poisoning' under the Health Act 1956 was amended in 2021 to a blood lead of 0.24 µmol/l or greater for all ages. It should be noted that values for venous blood, not capillary blood (finger pricks), should be used for determining action.

Clinical management of the case can be related directly to cumulative exposure, as this determines the severity of health effects and the treatment necessary (eg, chelation therapy for heavily exposed cases). Blood lead level is more closely related to short-term (past three to four weeks) than cumulative exposure but nevertheless provides a useful biomarker for the latter.

The environmental management strategy can also be based on the person's blood lead level, acting as a crude indicator of the extent of environmental lead contamination. It is desirable that lead hazards be removed wherever possible, because behavioural strategies benefit only those people who are currently at risk, and are a less certain way of controlling exposure than environmental modification. However, lead is widespread in the general environment. This means there is a 'law of diminishing returns', with little benefit to be expected from abatement at levels of environmental contamination corresponding to blood lead levels of approximately less than 1.21 µmol/l. Below this level, behavioural adjustment alone will usually suffice and extensive environmental sampling is not generally necessary, although any obvious lead hazards should still be abated.

At higher blood lead levels, or if the blood lead level fails to fall as expected or rebounds, more extensive environmental management is necessary (together with behavioural strategies).

The scope and scale of clinical and environmental response can therefore be graded according to the blood lead level of the case at notification (confirmed by an independent rebleed if close to a trigger value), although this should be interpreted flexibly according to the specific circumstances of each case.

Risk communication

Community perception of risk is not based on technical risk assessment alone. Public recognition of risks, in contrast to risk assessment based on probabilities prepared by experts, includes intuitive risk perception. The characteristics of such perception are related to concepts of fairness, familiarity, future and present 'catastrophic potential', and outrage at involuntary exposure to hazards not of their making.

Risk communication needs to be a two-way process and ongoing, as described in some detail the USEPA's *Risk Communication in Action: The risk communication workbook* (Reckelhoff-Dangel and Petersen 2007). The goal of risk communication is to establish trust and credibility. It needs to be done in such a way that people are well informed and guided in the actions they can take, while knowing that the experts are also taking account of, and acting on, people's concerns.

Specific situations may arise that require a proactive response from the public health unit. For example, an early childhood centre or school may have become identified as being lead contaminated as a result of poor maintenance, repainting or renovations (Gray et al 2009). It is important to recognise that parents and caregivers are likely to become very concerned if they are aware of raised environmental lead levels in the preschool or primary school environment. Information needs to be provided directly to parents and caregivers, through information sheets and/or public meetings, and via the media. This information should acknowledge the concerns but place them in the context of the children's overall exposure. It should be clearly explained that the risk is generally low (in the absence of other exposures such as from elevated lead in the home environment) and that children are unlikely to need blood testing.

Chapter 3: Risk reduction

Main points

- The focus of any investigation into lead-based paint should be on the hazards present (not just the identification of lead-based paint).
- A management plan to reduce lead exposure in the home should incorporate both behavioural (educational) and environmental (abatement) strategies.
- Risk reduction strategies should be appropriate to the scale and significance of the exposure to lead.
- Lead absorption equal to or in excess of 0.24 µmol/l is notifiable to the medical officer of health under Section B of Schedule 2 of the Health Act 1956.
- All lead absorption notifications should be entered into the Hazardous Substances Disease and Injury Reporting Tool.

Summary of the graded response protocol

The following recommendations provide an indication of appropriate responses to the results of the most recent blood test from the affected child (or non-occupationally exposed adult). These recommendations are based on international and national standards, but for all individual cases public health units should also be guided by the medical practitioner.

Blood lead ≥ 2.17 µmol/l

- Arrange urgent paediatric assessment. Advice for medical practitioners about chelation therapy is available from TOXINZ or the National Poisons Centre.
- Refer adults to a physician if blood lead is ≥ 3.4 µmol/l.
- Investigate sources of, and pathways of exposure to, lead using the standard questionnaire, visual observations, spot tests for lead-based paint, and laboratory analysis of appropriate environmental samples (paint, dust, soil, other).
- Abate all identified lead hazards (if the source is the house, temporary relocation will generally be recommended particularly if the case is a young child or more than one member of the house has a high blood lead level).

- Advise on behavioural strategies to reduce exposure to and absorption of lead.
- Check on environmental lead levels after abatement work has been completed.
- Modify intervention strategy and permit re-occupation depending on results.
- Monitor compliance with behavioural routines at three- to six-monthly intervals.
- Carry out further rounds of post-abatement environmental sampling as necessary.
- Monitor blood lead at six weeks then after another six months, and then annually to age six or until results fall below 0.24 µmol/l.

Blood lead 0.96–2.16 µmol/l

- In consultation with the child's general practitioner, refer to a paediatrician for assessment and possible neurodevelopmental testing (if not already done).
- Investigate sources of, and pathways of exposure to, lead using the standard questionnaire, visual observations, spot tests for lead-based paint, and laboratory analysis of appropriate environmental samples (paint, dust, soil, other).
- Abate all identified lead hazards
- Advise on behavioural strategies to reduce exposure to and absorption of lead.
- Check on environmental lead levels after abatement work has been completed.
- Modify intervention strategy and permit re-occupation depending on results.
- Monitor compliance with behavioural routines at three- to six-monthly intervals.
- Carry out further rounds of post-abatement environmental sampling as necessary.
- Monitor blood lead at six weeks then after another six months, and then annually to age six or until results fall below 0.24 µmol/l.

Blood lead 0.72–0.95 µmol/l

- Notify the child's general practitioner and discuss need for testing for iron deficiency anaemia and depending on the child's age, possible referral for neurodevelopmental testing.
- Investigate sources of, and pathways of exposure to, lead using the standard questionnaire, supplemented by visual observation and lead-based paint spot testing as needed. Abate any obvious lead hazards.
- Advise on behavioural strategies to reduce exposure to and absorption of lead.
- Monitor blood lead at six weeks then after another six months, and then annually to age six or until results fall below 0.24 µmol/l.

Blood lead 0.48–0.71 µmol/l

- Investigate sources of, and pathways of exposure to, lead using the standard questionnaire.
- Advise on strategies to reduce exposure to and absorption of lead.
- Repeat blood lead test at least six weeks following completion of abatement.
- If still within this range after retesting:
  - supplement earlier history taking with visual observation and lead-based paint spot testing as needed
  - abate any obvious lead hazards advise on behavioural strategies to reduce exposure to and absorption of lead
  - monitor blood lead after another six months, and then annually to age six or until results fall below 0.24 µmol/l.

Blood lead 0.24–0.47 µmol/l

- Investigate sources of, and pathways of exposure to lead, using the standard questionnaire, particularly if the person is a child or a pregnant woman.
- Advise on strategies to reduce exposure to and absorption of lead.
- Repeat blood lead test at three months following completion of abatement (the 6-week time for a repeat test noted for the level in the graded response protocol noted above may be too short a time to reliably detect a reduction in blood lead level at these lower levels).
- If still within this range after retesting:
  - supplement earlier history taking with visual observation and lead-based paint spot testing as needed
  - abate any obvious lead hazards advise on behavioural strategies to reduce exposure to and absorption of lead
  - monitor blood lead after another six months, and then annually to age six or until results fall below 0.24 µmol/l.

Note: if health protection staff are unable to follow up all notifications because of resource limitations, all notifications of children (ie, under 15 years) or pregnant women must be investigated. Given that the latter cannot be determined from direct laboratory notifications, all women of childbearing age (<45 years) should be investigated in these instances. Other notifications (ie, all women ≥45 and men ≥15 years) in this blood lead range should be sent information about lead absorption and reducing lead exposure and absorption of lead but an active investigation may not be required if resources are constrained.

Blood lead level <0.24 µmol/l

- No action required (unless there is another reason to investigate for a possible environmental lead hazard).

Lead absorption equal to or in excess of 0.24 µmol/l is notifiable to the medical officer of health under Section B of Schedule 2 of the Health Act 1956. All lead absorption notifications should be entered into the Hazardous Substances Disease and Injury Reporting Tool. Data for each district health board and New Zealand are reported annually by the Environmental Health Indicators programme, Massey University (**www.ehinz.ac.nz**) on behalf of the Ministry of Health.

Lead poisoning from occupational exposures is notifiable (by medical officers of health) to WorkSafe under section 199 of the Health and Safety at Work Act 2015.

WorkSafe recommends that a worker should normally be suspended by a Health and Safety Medical Practitioner where a single blood lead result is 2.4 µmol/l or greater (WorkSafe 2018). The suspended worker can return to work when follow-up tests indicate that the blood lead level has reduced to 1.93 µmol/l or below. The following exposure standards apply for lead in blood of occupationally exposed persons:

- a Biological Exposure Index of 0.97 µmol/l of whole blood
- a suspension (removal) level of 1.45 µmol/l of whole blood for females not of reproductive capacity, and males
- a suspension level of 0.48 µmol/l of whole blood for females of reproductive capacity, and those pregnant and/or breastfeeding (WorkSafe 2019).

Risk reduction

The range of risk reduction alternatives must be evaluated, including the social, economic and cultural implications of options.

This could be achieved along two lines: the control of actions and events that can translate a lead hazard into a lead risk, and the removal or near-permanent containment of the lead hazard.

Lead exposures in non-occupational settings may vary greatly. A protocol for the management of such exposures should aim to provide a response that is graded according to the likely harm.

Graded response protocol

The investigation and follow-up will be delivered over a series of visits and other contacts with the family (and other stakeholders). The exact number of visits, and precisely what is accomplished on each occasion, will vary depending on the graduated nature of the response and the unique circumstances of each case. The steps outlined below provide general guidance for the 'typical' case.

Stage 1: Initial investigation

1. Using the report sheets (Appendix 3), collect information from the principal caregiver (and other residents if appropriate) on:
   - current and past health status of the index case (including blood lead levels)
   - other children (including frequent visitors) who may also have been exposed
   - past, present and future environments that may have placed/may place the case at risk of lead exposure (including dwellings, early childhood centres)
   - lead-based paint hazards and other lead hazards to which the case may have been/may be exposed (including household members' occupations, traditional medicines and hobbies which may involve lead)
   - possible (open) pathways of exposure to these hazards
   - behavioural risk factors for exposure to or absorption of environmental lead.

2. Supplement information obtained by interview with visual observation of:
   - implicated environments, for evidence of lead-based paint and other lead hazards (use lead-based paint spot test as required, see Appendix 1: Testing for lead-based paint)
   - case behaviour, for evidence of risk factors for exposure to or absorption of lead (including location of principal play areas, extent of repetitive hand to mouth and mouthing behaviour, chewing on painted surfaces, pica)
   - household cleaning, hygiene and dietary routines.

3. Record data in the Record Sheets (Appendix 3). Locate lead-based paint hazards and principal play areas on the sketch map.

4. Based on this information, in consultation with the medical officer of health, decide whether or not to re-test the index case (to check blood lead). This will be influenced by the:
   - number of previous blood lead tests
   - currency of most recent blood lead test
   - closeness of reported blood lead to one of the trigger values outlined at the beginning of this chapter

- inconsistency between reported blood lead and apparent extent and duration of lead exposure.

5. Similarly, decide whether or not to test other household residents, frequent visitors to the household (or early childhood service), or pets (to assess blood lead as a biomarker of lead exposure). This will be influenced by:
   - vulnerability (preschool children, pregnant women)
   - likely sources and pathways of exposure.

6. Also decide (based on the information collected) which environments to investigate for lead hazards and exposure pathways. These may include:
   - environments in which the case currently spends significant time (more than five hours/week approximately) (including houses of grandparents or other relatives and extended family/whānau members, neighbours, friends, and early childhood centres, as well as the case's current usual residence)
   - settings in which the case has in the past spent significant time (in particular, previous residences and early childhood services where the case has lived or attended for more than six months).

7. If the decision is made to investigate any premises other than the current ones, then the appropriate sections of the questionnaire and visual observations (and spot tests) will need to be completed for those premises as well.

8. The questionnaire and visual observational data may be sufficient to clearly identify the likely source(s) and pathway(s) of lead exposure involved. If, in addition, the blood lead of the index case (pre-chelation) is less than 1.2 µmol/l, environmental sampling is unlikely to influence further management. Under these circumstances, Step 2 (*Environmental Sampling*) may be omitted.

Stage 2: Environmental sampling

1. Prepare a sampling plan based on information about likely sources and pathways from interview and visual observation. This will typically include samples of paint (if lead-based paint hazard(s) suspected) but occasionally of other sources such as ceramics, graphic materials, traditional medicines, drinking-water, and the major lead reservoirs such as dust and soil.

   A very important indicator of lead contamination can often be the obvious physical presence of lead flakes or dust. In a situation where the paint is known to contain lead, either through historical information (for example, the age of the building) or a presence or absence test, the presence of lead flakes or dust can often be used as an important tool, whilst waiting for confirmatory analysis results to become available.

2. Lead-based paint hazards include:
   - chewable painted surfaces (visible bite marks)
   - friction and impact surfaces (evidence of paint wearing and paint chips)
   - deteriorated paint (powdering, peeling, flaking, blistering or all of above)

- unsafe paint removal (past or current renovation/repainting).

Sampling of paint (refer Appendix 1) will be guided by age of the building component, condition of the painted surface, and history of renovation. In most circumstances, a field test (lead-based paint spot test, see *Testing for Lead-Based Paint*, Appendix 1) will suffice. Laboratory paint chip analysis should be used when the field test returns an unexpected result (ie, positive or negative or unclear, contrary to other evidence).

It is not the identification of lead-based paint but of lead-based paint hazards that is relevant – intact lead-based paint is not a health risk (except on toys, children's furniture and other chewable surfaces).

3. Sampling of dust will be guided by knowledge of likely sources of lead loading, use patterns (location of principal play areas), and cleaning routines.

   Sampling locations need to be carefully selected, and samples must be collected using a standardised technique and timed in relation to the time of last cleaning of the surface involved.

   In all but the most specialised situations, the wipe method is the preferred sampling technique for the measurement of indoor lead loading. Lead-containing material can become embedded within the pile of a carpet, for example, but it is only particles in the superficial layers which are likely to be able to be ingested or inhaled. Should other sampling methods be considered (for example, the vacuum method) laboratory advice must be sought prior to sampling.

   Provided these precautions are adhered to, the results can be helpful not only for risk assessment (by comparison with a recognised standard), but also for evaluation of intervention ('clearance') (by comparison of 'before' and 'after' samples).

4. Sampling of soil (refer Appendix 1) will also be guided by knowledge of likely sources, use patterns (location of principal play areas), presence of behavioural risk factors (especially pica), and nature of the ground cover.

   Visible paint flakes can be taken as evidence of high-level soil contamination (if the paint is lead-based), avoiding the need for laboratory testing in this situation.

   Also, soil abatement typically makes only a minor contribution to lead exposure control. An exception to this is the child with pica. In this situation, soil testing is of greater value.

5. Indicate the location and coding of environmental samples on a sketch map. The sketch map can illustrate sampling sites in relation to lead-based paint hazards and principal play areas.

   Enter field and laboratory test results onto the tables provided in the report sheets (Appendix 3), for ease of before/after comparisons or comparison with standards.

Stage 3: Risk reduction planning

1. Revise the initial assessment of sources/pathways/behavioural risk factors based on the result of laboratory analysis of the environmental samples, and further blood tests and clinical examinations.

2. Based on this understanding of the hazards and behaviours leading to lead exposure/absorption, design a risk reduction strategy in partnership with everyone who occupies the premises. Other stakeholders such as property owners and insurers may also need to be involved or kept informed. Insurers may accept the cost of some abatement work. The options for risk reduction include environmental (abatement) and behavioural (educational) strategies as outlined in the Summary of the graded response protocol, at the beginning of this chapter.

3. Environmental strategies include complete elimination (or near permanent enclosure) of the source, and interventions aimed to reduce the intensity of the source or exposure to it. Only the former are regarded as abatement strategies in the United States; the term 'interim control measures' being applied to the latter. However, 'abatement' is used inclusively in this guideline, in accordance with conventional New Zealand usage of the term.

   The major abatement strategies for lead-based paint hazards are:

   - paint film stabilisation
   - treatment of friction and impact surfaces
   - surface coating
   - enclosure
   - building component replacement
   - controlled paint removal.

   Enclosure, and (under suitable conditions and if available) surface coating, can provide abatement with a life of at least 20 years. Building component replacement and paint removal eliminate lead-based paint hazards permanently.

   Paint film stabilisation, and treatment of friction and impact surfaces will generally have an effective life of less than 10 years but, properly maintained and renewed, they can be effective indefinitely. Careful periodic monitoring is required that is more demanding than the monitoring of enclosures.

   Associated with every method of abatement is the need for meticulous care to avoid further lead contamination of the home environment and very thorough cleaning as a part of the abatement process.

   Soil abatement strategies include:

   - soft cover (grass, bark chips)
   - hard cover (paving, asphalting)
   - soil replacement.

   Management of soil and exterior dusts may require a neighbourhood rather than an individual property focus. Periodic monitoring of cover will be required.

   Strategies for other lead hazards will vary depending on the nature of the hazard and could include WorkSafe's involvement to reduce occupational take-home lead, replacement of plumbing fixtures to reduce lead in drinking-water, replacement of carpets, disposal of unsafe ceramics, cosmetics or (imported) canned food, or other strategies.

4. Educate the site occupiers that in most circumstances, abatement cannot be considered as a complete or permanent solution, but must be complemented by ongoing behavioural adjustments to reduce (remaining) exposure.

5. Behavioural strategies are essential accompaniments to abatement strategies, but may be used alone in some circumstances (see Summary of the graded response protocol). These strategies include:
   - house cleaning routines
   - personal hygiene practices
   - dietary habits (refer to Chapter 5).

   However, public health staff should be aware that education to change the daily behaviour of children, caregivers, visitors and so on, is very difficult to sustain long term.

   House cleaning routines are designed for dust suppression, and will typically involve a high-efficiency particulate air (HEPA) filtered vacuum – common detergent – HEPA filtered vacuum cycle. The extent and frequency of house cleaning will depend on the level of source control achieved and 'dustiness' of the environment.

   Hygiene practices refer to:
   - personal care such as handwashing
   - behavioural risk factors such as the extent of repetitive hand-to-mouth activity, nail biting, soil eating (pica)
   - access to interior spaces by pets and (exterior) dusts
   - use patterns, such as location of principal play areas, play activities and feeding practices.

   These interventions are designed to limit exposure to interior settled house dust and outdoor soil (the usual reservoirs of lead), by changing the daily behaviours of the case, caregivers, other residents, visitors and pets.

   As with any intervention, there may be unintended consequences. Caregivers need to understand that children's play activities and locations should be respected within the bounds of safety. Age-appropriate mouthing is essential exploratory behaviour; children should not be punished for nail biting or thumb sucking. Caregivers should not indulge in unnecessary cleanliness and 'dirt' avoidance.

   The extent of behavioural adjustment advice will depend on pre-existing household behaviours, household resources, the nature and severity of the lead exposure, and household composition. Typically, behavioural adjustments will need to be maintained (and kept age-appropriate) until the youngest child reaches six years of age.

   Dietary modification can reduce absorption of ingested lead in young children from approximately 50 to 10 percent of ingested doses. A careful assessment of nutritional status, diet and feeding practices is essential. This should be conducted by or with a dietitian and the assessment may include blood tests to determine iron status. Risk and protective factors include:
   - frequency of feeding
   - fat intake
   - phosphate intake

- intake of calcium, iron and zinc
- vitamin C intake.

Iron status is relevant not only because of its influence on lead absorption, but because of the interaction between iron deficiency and lead exposure on cognitive development. Iron deficiency is also a recognised cause of pica.

Stage 4: Risk reduction implementation

1. While the household has the ultimate responsibility for making and maintaining behavioural modifications (with the support of the public health team), responsibility for environmental abatement lies with the property owner (who may or may not be the occupier).

2. Ensure that the household (and property owner/landlord if different) participates fully in the development of the plan and feels 'ownership' of it. Recognise barriers to implementation of the plan and provide support as required to overcome them. Possible barriers include:
   - lack of information or understanding of what is required (and why)
   - lack of confidence in their ability to carry out the task
   - lack of feedback regarding progress
   - lack of financial or material resources needed to carry out the task
   - lack of motivation (eg, belief that lead exposure is not harmful or that recommended interventions are useless; low priority given to chronic lead exposure versus more acute threats to case or family health)
   - language or cultural barriers.

3. As well as attention to these barriers, successful implementation of risk reduction strategies requires:
   - maintenance of open and clear communication with the household (and other stakeholders) throughout the process
   - direct observation (and supervision if required) of at least the major interventions (environmental and behavioural) to ensure both safety (avoidance of unintended outcomes) and compliance
   - ongoing monitoring, evaluation and feedback (plus corrective action as necessary).

4. On rare occasions, cooperation from a household or landlord may not be forthcoming. Try to determine the underlying problem through supportive discussion. If previously unrecognised barriers to implementation can be identified and overcome, the situation may be amicably resolved.

   If this is not possible, legal action may be necessary to ensure the safety of the case. Discuss this fully with the household (and their legal representatives if any) and the local authority. Options for enforcement of abatement include:
   - action under the Health Act 1956

- action under the Building Act 2004.

Choice will depend on the circumstances of the case and the decision of the territorial authority which has duties and powers under the Health Act 1956. Section 124 of the Building Act 2004 provides territorial authorities with powers regarding buildings which are dangerous or insanitary. If the dwelling cannot be made lead safe by action taken under either of these statutes, a closing order under sections 42 or 44 of the Health Act can be issued to prevent occupancy by families with young children (refer to Chapter 6).

5. The owner of the building will require a building consent under the Building Act 2004 from the territorial authority for risk reduction (abatement) work involving any building work not exempt under the Act. The territorial authority should be consulted about work that may, or may not, require a building or resource consent (refer Chapter 6).

Stage 5: Risk reduction evaluation and monitoring

1. **Clearance testing**

   Carry out clearance (post-abatement) testing if significant abatement work has been done. This will enable the short-term impact of the abatement to be evaluated. The timing of clearance sampling is important, as many abatement processes (such as paint removal) will generate transient increases in dust (and soil) lead levels. Collection of clearance samples should be delayed (or repeated) six weeks after completion of the work for this reason.

   Post-abatement dust and soil lead loadings or concentrations may be compared with a standard 'clearance level' such as the US EPA values used in this guideline.

   Provided samples are collected consistently, comparison of pre-abatement with post-abatement levels (before/after comparison) may have greater validity.

2. Based on this interpretation, decide whether it is safe to permit reoccupation (if the people concerned have been temporarily relocated to lead-safe accommodation). This may require clearance testing immediately following the post-abatement clean-up, in which case a further round of clearance testing will be required six to eight weeks later. Also decide on any necessary changes to the risk reduction strategy, and plan any further evaluation and monitoring, in consultation with the household.

3. **Monitoring**

   Depending on the result of abatement, liaise with the local authority about whether any other action needs to be taken.

4. **Serial blood lead monitoring**

   While clearance and subsequent rounds of environmental sampling may provide useful information for monitoring and feedback, the key evaluation tool is serial blood lead measurement (which may be restricted to the index case or broadened to include other exposed residents, depending on the situation).

   Blood lead is a biomarker that integrates exposures from all sources, across all media, and furthermore reflects exposure over the preceding three or four weeks more closely than cumulative exposure. As such it is ideally suited for use as an indicator of short-term trend in exposure. Nevertheless, prolonged chronic exposure will reduce the expected rate of fall of blood lead, because lead is mobilised from bones (ie, reduction of external lead source will be partially compensated by substitution of an internal source).

   In many circumstances, a rate of fall in blood lead of more than 0.10 µmol/l/month may not be achievable (without chelation, which may be clinically indicated for a case with a high blood lead level). As blood lead drops below 1.2 µmol/l, even this modest rate of decline may not continue.

   Also, a transient rise in blood lead immediately following abatement is not unusual, reflecting mobilisation of environmental lead during the abatement process.

   For these reasons, it is recommended that blood lead not be retested until at least six weeks (or three months for the 0.24–0.47 µmol/l range) following completion of abatement/implementation of a behavioural risk reduction strategy.

   Blood lead should then be tested again after six months and then annually until age six or until results fall below 0.24 µmol/l.

   (If the case has been referred for paediatric assessment, or has received chelation therapy, the times and frequency of serial blood lead measurements will be coordinated by the paediatrician or physician.)

   For children with a blood lead level below 0.48 µmol/l, the time needed for a decline in blood lead level in response to a public health intervention is unknown.

   For higher blood lead levels, the time to reduce to below 0.48 µmol/l is months to years depending on the level and duration of exposure (Binns et al 2007).

It is important that the family have realistic expectations about the rate and extent of decline in the case's blood lead that can be achieved. Unless initial blood lead is dangerously high (over 2.17 µmol/l), a slow but reasonably steady decline to less than 1.2 µmol/l (and preferably below 0.48 µmol/l) will generally be sufficient to prevent any clinically detectable impact on growth or development (at the level of the individual case). A levelling out of the blood lead level over three to six months at levels over 0.24 µmol/l, or rebound in blood lead, would be cause for concern and re-evaluation.

Stage 6: Risk management

If serial blood lead measurements level out or rebound (or if serial environmental samples indicate recontamination), corrective action may be necessary.

1. Recheck compliance with behavioural protocols. (Is house-cleaning equipment functional? Are procedures fully understood?)

2. Recheck completeness and integrity of the abatement work already done.

3. Search for additional lead hazards (including unusual sources or pathways of lead exposure that may have been overlooked in the investigation stage).

4. Consider additional environmental sampling to pinpoint hazards and confirm (open) exposure pathways, and increase frequency of serial blood lead measurements (blood lead testing of other household residents and pets should also be reconsidered).

5. If an amenable cause can be identified, this may be corrected. On the other hand, it may become clear that extensive additional abatement work is necessary. This may be impractical (the necessary abatement work may cost more than the house itself), in which case the family will require permanent relocation in lead-safe housing. In this situation, the family will need to be counselled and supported. The public health case manager will need to liaise with the local authority and may need to advocate on the family's behalf with insurers, and Crown agencies such as Kāinga Ora – Homes and Communities and Work and Income New Zealand.

Chapter 4: Risk reduction – abatement

Main points

- A management plan to reduce lead exposure in the home should incorporate both behavioural (educational) and environmental (abatement) strategies.
- Risk reduction strategies should be appropriate to the scale and significance of the exposure to lead.
- Removal of intact lead-based paint is not recommended – it only increases the hazard.
- The general principles for safe abatement should be followed.
- The affected household (and the building owner if different) should be involved in decisions on appropriate abatement strategies.
- In choosing an abatement method, ensure that the alternatives to the removal of the paint have been fully considered.
- When removing lead-based paint ensure that steps are taken to protect occupiers, workers and the environment from contamination.
- For small areas, wet scraping and wet sanding are the preferred methods. Chemical stripping can be used. Heat stripping is not recommended.
- Only power sanders that are fitted with HEPA filters should be used.
- Abrasive blasting should never be used on domestic premises.
- Debris from paint removal should be disposed of carefully and in accordance with any local authority requirements.
- Areas of contaminated soil can be covered over with a soft cover (eg, grass, bark chips), a hard cover (eg, paving), or removed and replaced, depending on the level of contamination.
- Where soil is removed and replaced, the replacement soil should have as low a lead concentration as possible, but not greater than 210 µg of lead/g of soil on a residential property.

Introduction

The goal of (safe) abatement of lead-based paint hazards is the long term, sustainable reduction of interior settled house dust lead loading, while minimising any transient (short-term) increase in environmental contamination with lead.

To achieve this goal, a set of general principles for safe abatement have been developed (adapted from US HUD 2012).

Principles of safe abatement

1. Identify and carry out essential repairs to components of the building that may further deteriorate and release leaded dust or compromise the integrity of abatement measures.
2. Carry out abatement activities so as to minimise the generation of leaded dust during the process.
3. Contain and safely dispose of all dust generated by abatement (as well as other abatement waste).
4. Protect occupants during the abatement (if necessary, temporary relocation of preschool children, pregnant women and pets, restriction of site access for those vulnerable groups until environment made lead safe).
5. Protect occupants' belongings during the abatement (preferably safe storage out of the house, or as a minimum dustproof cover for all furniture, furnishings, surfaces, clothes, utensils that may receive dust).
6. Carry out a thorough post-abatement clean-up (involving at least one cleaning cycle, ie, high-efficiency particulate air filter (HEPA) vacuum – common detergent wash – HEPA vacuum).
7. Facilitate ongoing dust suppression by occupants after abatement.
8. Complement source control and ongoing dust suppression strategies with hygiene and dietary routines to further reduce exposure to and absorption of lead.
9. Evaluate outcome by serial blood lead measurement. Carry out clearance testing (and further rounds of environmental sampling) as an additional evaluation/feedback tool if necessary.

Abatement strategies include:

- treatment of friction and impact surfaces
- paint film stabilisation
- surface coating
- paint removal
- enclosure (including sealing)

- building component replacement (including replacement of carpet and soft furnishings)
- soil cover (soft and hard)
- soil replacement.

These strategies vary in their effectiveness, appropriateness in different situations, requirement for ongoing maintenance, and cost. Whichever strategy or combination of strategies is selected, the building owner and the occupants should be fully involved in the decision. They should understand the cost implications (including the costs of essential repairs), the need for temporary relocation, the need for clearance testing prior to re-occupation, and the need for ongoing behavioural controls. Advice about accessing insurance or other financial support may need to be provided, and to obtain temporary lead-safe accommodation.

The abatement strategies described here are secondary prevention measures that need to be taken in the event of a person being exposed to lead. As a step towards primary prevention the Ministry of Health, the Health Promotion Agency, and the Ministry of Business, Innovation and Employment updated the *Guidelines for the Management of Lead-Based Paint* in 2013. This document should be consulted for advice on primary prevention strategies (many of which are similar to secondary prevention interventions based around the investigation of a lead-exposed case).

Selection of contractors and materials

All paint removal, stabilisation and repainting should be carried out by reliable, suitably trained and experienced painting contractors certified by Master Painters New Zealand (MPNZ) in the management of lead-based paints. MPNZ arranges training programmes on the management of lead-based paint for their members, apprentices and the wider painting industry. Those that successfully complete the training are designated as 'Lead Based Paints Accredited Contractor' (hereafter called 'accredited painting contractor') and should be able to provide evidence of the certification upon request.

Contractors for other building work, such as enclosure, should be selected for reliability and experience and be aware of the lead hazards and protective measures required.

The success of several abatement measures (other than enclosure and component renewal) rely on new paint films. A paint system that is compatible with the existing paint film, exposure and use must be selected. The advice of paint manufacturers (who have responsibilities under the Consumer Guarantees Act 1993 and the Fair Trading Act 1986 regarding the advice given and claims made for products) should be sought on the most appropriate complete paint system and methods to be used. Similarly, surface coating systems using specialist liquid coatings (if available as discussed later) should be chosen on the advice of specialist manufacturers.

Essential repairs

The first step in abatement is to ensure that existing or latent conditions that could undermine the success of the abatement work are corrected before work starts; in particular, attention is required to correct structural deficiencies, moisture problems, and surfaces that are difficult to clean.

Structural deficiencies, such as inadequate foundations and piles; inadequate, rotten or decayed structural timber in walls, floors and roofs; may permit movement in the structure (or provide inadequate fixing) and cause subsequent damage to abatement measures, especially those employing enclosure.

External moisture penetrating the building envelope will cause deterioration of the structure, floors and roofs as well as the building's external cladding and interior lining. Moisture penetration from the ground and through walls and roofs will compromise all abatement measures, as well as being a potential cause of environmental conditions that are harmful to health. Attention should be paid to every cause of dampness that should be corrected including, conditions on the site and around the house, under-floor moisture and ventilation, damp-proof courses, external cladding (moisture in weather boards should not exceed 14 percent if paint film failure is to be avoided), windows and glass, roof leaks, chimney caps, gutter and downspout problems, roof flashings, external cover strips and trim, missing or damaged external doors, joint sealants, and window and door fastenings.

Other sources of dampness should be eliminated that may be caused by internal plumbing leaks, blocked or defective drains, failed linings and sealants around showers, basins, baths and sinks.

Surfaces that are very difficult to clean should be renewed or covered with easily cleaned material whether or not they generate lead dust themselves.

Consideration should be given to necessary rewiring or plumbing remodelling before abatement work starts because subsequent disturbance of the internal lining of the house may cause lead hazards to recur.

A decision whether to proceed with essential repairs and subsequent abatement of lead-based paint hazards will depend on the location, age and condition of the building, its siting in relation to natural hazards (eg, flooding), the cost of essential repairs, the extent of the paint and any other lead hazards, the economic life that may be expected in the light of these factors, and the present and future values of the property.

In many instances a lead hazard arises during renovation of an older property where the economics of renovation are favourable and the essential repairs are likely to be planned and budgeted for anyway. When enclosure is chosen as the preferred method of abatement there are opportunities to incorporate other benefits such as improved insulation (eg, the use of insulated external cladding), improved durability and aesthetics.

Other situations may arise where the property is very run-down, poorly located (or subject to flooding) and uneconomic to renovate. In such a circumstance a careful decision is required by the building owner before embarking on repairs and abatement that may

prove uneconomic. Rehousing the occupants will become a priority and demolition of the building, with suitable precautions to prevent lead contamination of the site and surrounding areas, would be preferable to it remaining standing and presenting a growing hazard with further decay and becoming an attraction to illegal occupation. Close cooperation with the territorial authority would be needed in such circumstances.

Paint film stabilisation

The objective of paint film stabilisation is to prevent existing lead-based paint layers from deteriorating further and releasing more lead into the building environment. It is a process akin to normal repainting but with extra care and thoroughness. It is likely to be the abatement measure of least initial cost, but ongoing monitoring and a probable life of less than 10 years may not make it the least cost solution in the long run. If the existing lead-based paint film (even though chalking) and the underlying paint layers and substrate are sound and well bonded together stabilisation should be considered.

Paint film stabilisation is appropriate where:

- a life of the abatement measure of less than 10 years is appropriate
- regular monitoring of the integrity of the stabilised surface is practicable
- the substrate supporting the paint film is sound and will not be subject to deterioration and dampness (following essential repairs if necessary)
- the paint film is adhered well to the substrate and unlikely to become poorly adhered
- the surface is unlikely to be chewed or damaged by impacts or wear and tear.

Lead-based paint is oil-based almost without exception. As it ages it becomes hard, usually glossy (unless outside where it may be chalking), of low permeability, and inflexible. Accordingly, the paint film is vulnerable to failure from moisture in the form of water or water vapour under the paint film, expansion and contraction of the substrate, and factors producing poor adhesion to the substrate (including layers of wallpaper under the paint). If any of these conditions are present, paint film stabilisation is inappropriate and, because the paint film is failing (or there is risk that it will do so), it should be regarded as an actual or potential source of lead that may need to be abated using other methods.

In many instances, lead-based paints will have been painted over already and, if former preparation has been inadequate, the subsequent coats may be peeling off. If the peeling coats can be removed safely and the underlying lead-based paint is sound, paint stabilisation may be a satisfactory option.

Roofs have been identified as a contributing source of soil lead around the house (and a potential source of lead contamination of water if a roof water supply is used). Paint film stabilisation may be a satisfactory option if water is not collected.

When advising on paint film stabilisation the health protection officer should consider a number of factors.

Suitability

Confirm the suitability of the existing surface for stabilisation by adhesion tests for adhesion to underlying coats of paint and the substrate using adhesive tape (press on firmly about 100 mm of wide adhesive tape, wait a few seconds and pull off; contain and dispose of carefully). Where deterioration is evident carry out one or two tests on each square metre; otherwise one test each 5 square metres will suffice. If poorly bonded areas exceed some 10 percent of the total area (requiring paint removal over those areas), or the condition of the substrate will not be rectified by essential repairs, other abatement methods should be considered.

Identify all areas that require other abatement measures (eg, friction and impact surfaces, surfaces that may be chewed or subject to heavy wear, or roofs used for the collection of water).

Essential repairs

Identify all essential repairs to remove factors likely to cause subsequent failure of the stabilised surface.

Contractors

An accredited painting contractor should be selected by the building owner. Essential repairs will require the services of a building contractor first.

Surface preparation

Surfaces will need to be prepared by washing, wet sanding and scraping to remove dirt, grease, mould (spores need to be killed by proprietary mould inhibitors), remnants of cleaning solutions, loose paint patches and surface gloss and, in the case of chalking surfaces, pigments (principally lead-based) that have become free from the paint film binder. If timber has a moisture content of more than 14 percent, the impermeable layers of old paint may be forced off by water vapour. Precautions should be taken to prevent water entering the end grain of timber during surface preparation. The procedure requires the same precautions as those described later for paint removal to protect occupants, workers and the environment although the amount of lead-based material released and removed will be considerably less. This is the stage causing the greatest lead hazard.

Paint system selection

A paint system that is compatible with the existing paint film, exposure and use should be selected with the advice of a paint manufacturer. A total dried paint film thickness of no less than 2.5 mm is required (US HUD 2012). The manufacturer should be provided with all relevant information about the job and asked to advise on the required coverage (m^2/l of paint) to obtain adequate dried film thickness. All paint should be selected to provide outstanding adhesion, durability, chemical resistance and flexibility.

Application of the paint system

Spot priming is required of all areas where bare wood or metals are exposed after preparation using suitable primers for wood, zinc coated surfaces or other metals (including treatment of rust) following the paint manufacturer's recommendations.

Apply specified undercoat and topcoats at the recommended coverage and within the times recommended to ensure good bonding between coats (and curing in the case of acrylic paints) and the avoidance of dirt and salts (in coastal areas) being deposited on paint surfaces between coats.

Protection and clean-up

Conduct thorough clean-up (standard cleaning cycle), especially if any paint removal was required.

Monitoring

Plan how monitoring of the stabilised paint film will be carried out. As a minimum (assuming lead dust levels are below clearance levels) it is suggested that the owner should carry out annual visual inspection and contact the health protection officer if necessary. Paint film life can be extended considerably by annual inspection and maintenance. The owner should be encouraged to carry out checks and have work done (spot wet scraping, spot priming and repainting). Independent inspection is recommended at six months, to verify that the stabilisation of the paint film is not showing signs of early failure, and then at years five, eight and ten. If the paint film is still sound at ten years, inspections should continue at, say, two-year intervals especially if there are children under six years old in the house.

If restoration measures (including further essential repairs) appear insufficient to provide a continuous and well-attached paint film, the complete process should be repeated or, if the method is proving unsatisfactory, alternative abatement methods should be considered.

Surface coating

Surface coating is defined as the process of making a lead-based paint hazard inaccessible by providing a robust flexible barrier between the lead-based paint and the surface. The barrier is formed using a liquid-applied coating, or a covering material bonded by adhesion to the existing lead-based paint film. It is therefore highly dependent on the integrity of the existing surface for its performance.

Surface coating technology using special liquid coatings is reported as used less often than other abatement methods in the United States (US HUD 2012). The US HUD guidelines also note that the disadvantages of this abatement method appear to have outweighed the advantages in many cases. At present, the paint manufacturers consulted in New Zealand are not confident that surface coating using liquid coatings is a

satisfactory option or that they could offer liquid coatings for surface coating that met the intended purpose.

Surface coating may be appropriate where:

- a life of the abatement measure of 20 years is sought
- regular monitoring of the integrity of the coated surface is practicable
- the substrate supporting the existing paint film is sound and will not be subject to deterioration and dampness for the next 20 years (following essential repairs if necessary) and be capable of supporting the weight of the surface coating layer
- the existing paint film is very well adhered to the substrate and unlikely to become poorly adhered
- the surface is unlikely to be chewed or damaged by severe impacts or excessive wear and tear.

Surface coating should be differentiated from **enclosure**, in which the barrier is rigid, is mechanically fastened to the substrate and does not depend on the integrity of the existing paint film for its performance. It should also be differentiated from **encapsulation**, in which the paint is isolated or enclosed on all sides.

Surface coating depends on a successful bond between the surface of the existing paint film and the coating. In addition, all layers of the existing paint film must adhere well to each other, and the innermost layer must adhere well to the base substrate. All the prerequisites for paint film stabilisation apply to surface coating but, because the surface coating layer is thicker, heavier and more costly than paint, the risk (and the cost) of failure is greater.

Surface coating, therefore, has only limited application as an abatement technique, and can be used only when the nature and condition of the existing paint film and substrate allow. Surface coating is unsuitable for friction and impact surfaces.

Canvas-backed vinyl wall coverings attached by heavy-duty adhesives (occasionally used in commercial situations) would be suitable as a surface coating but may be difficult to obtain. Heavy-duty vinyl wall coverings (paper base with a bonded heavy-duty vinyl layer) attached by heavy-duty adhesives is readily available and may be applied by experienced decorators; a life of 20 years could be obtained under conditions without heavy wear. In suitable locations, tiles (eg, ceramic, vinyl, faced hardboard) or other materials secured by adhesives may be considered as suitable surface coatings. Specialised liquid coatings and reinforced liquid coatings may become available but should only be used if supported by firm guarantees from a manufacturer.

Sealing of wooden floors with a polyurethane coating to create a smooth, easily cleaned surface may also be regarded as a form of surface coating. This is particularly important for tongue-and-grooved or wood block parquet floors, because such surfaces are otherwise very difficult to clean adequately. (Wood board floors that are not tongue-and-grooved may present gaps that collect dust that cannot be removed satisfactorily and coating with glued and pinned hardboard with a suitable decorative and wearing surface such as vinyl tiles may be necessary.)

When advising on surface coating, the health protection officer should consider a number of factors.

Suitability

Confirm the suitability of the existing surface for surface coating in a similar manner for paint film stabilisation. If poorly bonded areas exceed some 10 percent of the total area (requiring paint removal), or the condition of the substrate has deteriorated and will not be rectified by essential repairs, other abatement methods should be considered.

Identify all areas that require other abatement measures (eg, friction and impact surfaces, surfaces that may be chewed or subject to very heavy wear).

Essential repairs

Identify all essential repairs to remove factors likely to cause subsequent failure of the surface coating.

Contractors

A reliable and suitably trained and experienced contractor should be selected by the building owner.

Surface coating system selection

Surface coating of internal surfaces using tiles (of various types), and heavy-duty vinyl wall coverings need to be appropriate for the exposure (eg, may be unsuitable above sinks and basins) and use of the area. Adhesives must be compatible with the existing paint film, and an assessment should be made whether the existing paint film can support the weight of the surface coating.

If liquid-applied surface coatings are available, the advice of alternative surface coating manufacturers should be sought for a complete systems and methods of application. Establish whether repairs to liquid applied systems are feasible and whether specialists would be required. The manufacturers should be provided with all relevant information about the job and asked to advise on the required film thickness suitable for the location in the house and the desired life of the system. All systems should be selected to provide outstanding adhesion, durability, chemical resistance, flexibility and ease of cleaning. A decision will be required on which system is most suitable and offers the best warranty. Field patch tests are advised to confirm compatibility with existing paint films, the ability of paint film to support extra weight, and the adequacy of surface preparation methods.

Surface preparation

Preparation is generally similar as that for paint film stabilisation, but specialist coatings manufacturers may require their own specification to be followed.

Application of the surface coating system

Ensure that manufacturers' recommendations are followed, especially with regard to thickness of specialist liquid coatings (thickness gauges are available). For tiles and other coverings ensure complete coverage of the lead-based paint and sealing of gaps. Edge and corner protection will prolong the life of such surface coatings.

Protection and clean-up

Conduct thorough clean-up (standard cleaning cycle), especially if any paint was removed.

Monitoring

Plan how monitoring of the surface coating will be carried out. Monitoring frequency should be adapted if lead dust levels remain close to or exceed the clearance levels. As a minimum (assuming lead dust levels are below clearance levels) it is suggested that the owner should carry out annual visual inspection and contact the health protection officer if necessary. Any failure of specialised systems should be reported to the manufacturers and/or applicators and remedies sought under warranty or the Consumer Guarantees Act 1993. Maintenance of simple surface coating systems such as heavy-duty vinyl wall coverings or tiles may extend their life and be carried out by appropriate contractors. Maintenance of specialist coatings may need to be done by the manufacturer or the applicator. Independent inspection is recommended at six months (to check that the surface coating system is not showing signs of early failure) and subsequently at five-year intervals.

If specialised restoration measures appear insufficient to provide a continuous well attached and robust surface coating the complete process should be repeated or, if the method is proving unsatisfactory, consider alternative abatement methods.

Treatment of friction and impact services

Friction surfaces are those surfaces subject to abrasion which may liberate leaded dust. Examples are window and door surfaces that rub together on opening and shutting, cabinet doors and drawers, stairway treads and railings, and floors (including exterior decks and porches).

Impact surfaces are generally protruding surfaces prone to being banged or bumped, thus causing small chips of lead-based paint to fall to the floor. Most common impact surfaces are doors, door jambs and architraves, skirting boards, stair tread edges and risers, edges of sills and shelves and chair rails. Other surfaces may be banged by young children, including cots, toys and furniture.

Movement and settlement in the building may have reduced clearances between doors and window sashes and their frames, or dampness may have caused swelling of timber.