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Town Manager  
c/o Mr. Paul Fenton  
Coordinator  
City of Cape Elizabeth  
320 Ocean House Road  
PO Box 6260  
Cape Elizabeth, Maine 04107

July 27, 2015

RE: Range Design Evaluation Report  
Spurwink Rod and Gun Club  
1250 Sawyer Road  
Cape Elizabeth, Maine 04107

Paul:

This shall serve as a final report for the above referenced project. It is intended to give review and recommendations to the questions raised by the City of Cape Elizabeth and concerned citizens regarding the safety of the subject range. This report is backed-up by our professional practice, over 10-years of national experience in gun range design / consultation and our visit to, and review of, the physical range characteristics / range standard operating procedures and discussions with the current range master. This report (and our service) does not include review of, or recommendations for, any environmental factors or remediation or the operation or protocol of the range. This report addresses the physical aspects of the site, firing line and target stations only.

This report does not attempt to review or make recommendations regarding the operation, protocol, management or training practiced or provided at this range as none of these were observed during any site visit. While some data and information regarding the operations of the range was provided for review, no claim can be made in this report as to the implementation or control demonstrated during actual operation.

Disclaimer of Liability:

The National Rifle Association and R Design Works does specify dimensions for range layout in NRA sanctioned shooting events, but does NOT certify or in any way approve ranges or range design for any purpose. While every effort has been made to provide up-to-date technical information, this report is in no way to be used as a substitute for, or in lieu of, consultation with architects, engineers and attorneys who shall be called upon to make recommendations for individual range design, construction and use of shooting ranges. The NRA Range Source Book is NOT a code book or certification standards, but rather a publication listing general suggestions. Each range is site specific, fact sensitive, risk driven, and needs to be considered in that light. The National Rifle Association assumes no liability for information contained therein.

In order to build and operate a safe shooting range, the plans, specifications and construction of said range require the thorough professional evaluation, guidance and services of professional engineers and architects. This source book is under no circumstance to be viewed as a restatement of the law in any jurisdiction or to assume compliance with any applicable federal, state or local laws, ordinances, rules or regulations. You must consult a local attorney to ascertain compliance with all applicable federal, state or local laws, ordinances, rules or regulations and to advise you the applicable duty of care requires of operators of a shooting range in your jurisdiction.

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**General Summary**

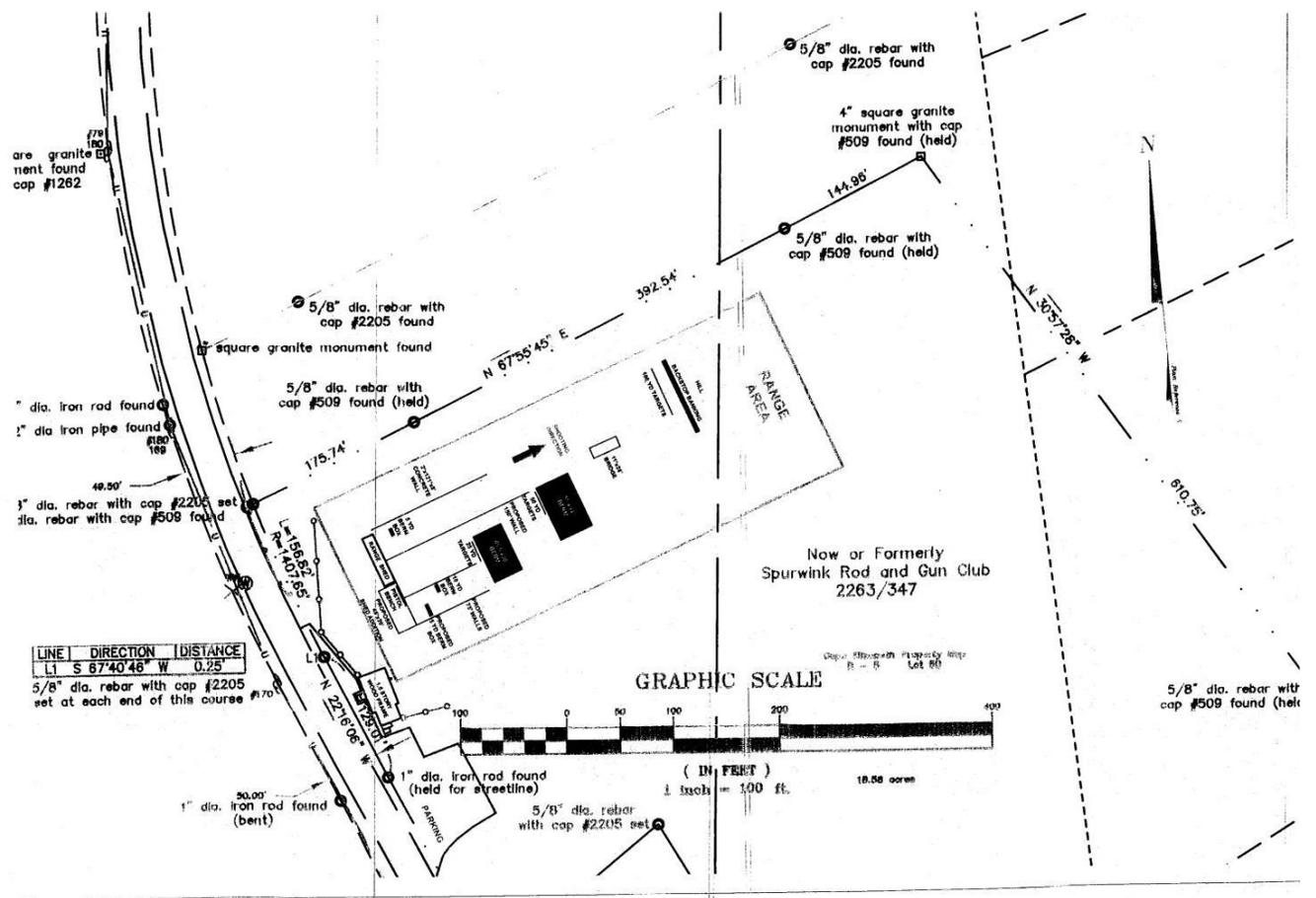
The Spurwink rifle and pistol range is an average facility and is located appropriately for shooting activities, once remediation has been completed. It appears to be maintained minimally and to be operating as intended. It's use is appropriate as a gun range and the overall design of the firing line although the facilities are below average for a range of this type and size. However, the relationship (elevation, distance and allowed ballistics) between the firing line, targeting location (100 Yard and less), the existing ridge, adjacent residences and ballistics allowed are not adequate to avoid any direct-fire, ricochets or fragments from leaving the property or range.

No definitive property boundary was provided but satellite images and topographic map overlays suggest the angle of incidence is too slight to adequately attempt to contain live fire. The relationship of in-line points, inadequate target station design and too much firing line "blue sky" towards down-range targets, contributes to the potential of rounds escaping the property.

Club Suggested Project and Schedule  
Anticipated  
Date

Projects Completed	May/June 2015	Acquire enough clean fill to level 10 meter, 25 yard, 50 meter and area out to 100 in front of 100 yard shooting area.
	May/June 2015	Cover the portion of the concrete wall with rubber shred material that has become uncovered due to settling.
	May/June 2015	Place cleaned fill sufficiently to raise the ground to the 50 meter target area and the 100 in front of the 100 yard target area. The majority of the range (everything but the 25 feet in front of the 100 yard target) is now at its roughed in height awaiting ballistic sand material.
Projects to be completed	7/31/2015	Complete replacement of stairs leading to range area.
	7/31/2015	Repair of fence crushed by tree.
	7/31/2015	Secure shooting tables to concrete slab of shooting shed.
	7/31/2015	Repair knee wall directly in front of and below shooting tables.
	7/31/2015	Install emergency first aid kit (gun shot specific) in shooting shed area.
	7/31/2015	Install emergency cell phone and charging station in shooting shed area.

7/31/2015	Install ballistic sand material, lime and grass seed to the S.D.Z in front of 25 yard berm.
7/31/2015	Secure temporary shooting bench to concrete slab
7/31/2015	Remove steel I beam holding up targets at 100 yard area.
12/31/2016	Install another concrete wall between 25 yard and 50 meter shooting area.
12/31/2016	Install ballistic sand, lime, grass to 100 yard shooting area.
12/31/2016	Bring concrete walls (wood wall access openings) all the way to concrete slab of shooting shed
12/31/2016	Install posts for final wood/ rubber hybrid wall at 50 meter range area.
12/31/2016	Refine the Lead Management Plan.
12/31/2017	Install "no blue sky" baffles
12/31/2017	Cover baffles with ballistic rubber material
12/31/2017	Install eyebrow panel over 25 yard berm
12/31/2017	Install rubber shred material and re-activate 50 meter shooting area.
12/31/2017	Refine LMP
12/31/2018	Replace existing road to 100 yard target area
12/31/2018	Install eyebrow on 50 meter berm
12/31/2019	Install concrete wall at 100 yard area
12/31/2019	Install rubber shred to concrete 100 yard berm
12/31/2019	Install eyebrow to 100 yard berm



**Observations / Review**

Targeting station summary (between Firing Line station elevation / location and Targeting Station elevation / location):

Yardage	% of Incline to Slope Breach	Degrees to Slope Breach
Down-range ridge (233 Yards)	8.6	5

While no design is typically feasible or possible at this or most other ranges that would completely eliminate the potential of downrange projectiles leaving the property boundaries, the existing range facility could use improvements in several areas to increase safety and attempt to eliminate projectiles from leaving the property boundaries to a much greater degree. After analyzing the small-bore pistol and rifle targeting areas (100-yards and less) regarding locations, angle of incidence, angle of anticipated ricochets (or caroms), general topography of the site (taken from GPS locations and site information), target vertical elevation relative to the firing line stations vertical elevation, the targeting areas horizontal location relative to each "most outside" firing line station location (two for each side of the range), the general condition of the ground / soil and calculating trajectory opportunities for each of the five down-range targeting areas (yardages of 5, 10, 25, 50 and 100) and the ballistic allowed ...we make the following recommendations:

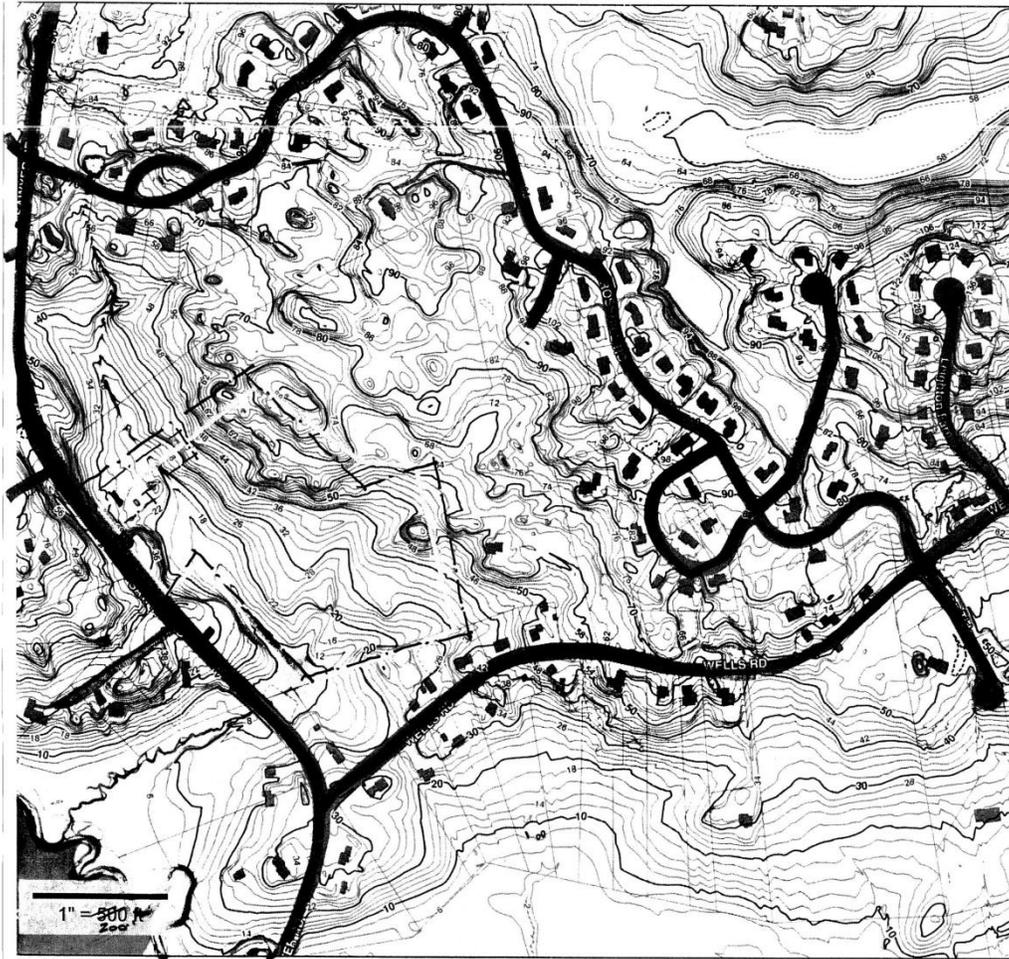
While the existing range is in the process of implementing a plan of improvements, a more comprehensive approach to containment and sustainability needs to be considered, designed, funded and implemented to provide a safe environment for users and contiguous property owners. Elements of this approach are as follows:

1. An accurate topographic and environmental survey needs to be conducted of the existing site to establish the existing conditions for the basis of design and engineering.
2. A comprehensive "Range Manual" needs to be compiled addressing procedures. Additionally, a narrower limit needs to be established for the ballistics, fire-arms and powder charges allowed on this range. Once that is determined, the range designer can better design to contain live fire.
3. A range designer needs to be retained to work with the gun club and city to determine the exact requirements for containment. At that time, a range baffling, containment, no blue-sky, sound dampening or other systems can be engineered. These decisions can also incorporate schedule, budget, phased use, limited use and any other (environmental) considerations.

Until the above steps are begun or implemented, we recommend the city of Cape Elizabeth request the existing range to discontinue use of any live fire. The reasons are as follows:

1. All ballistics that are currently indicated as "allowed" at the range have the potential of leaving the range site and property. Also, current "down-range" users and residences are within the distance these ballistics "allowed" can reach.
2. There is currently no containment system in place. The angle of trajectory needed to exit the property is only 8.6% (5 degrees). This is not significant enough to assure live-fire (or ricocheted-fire or fragmented-fire) does not create an unsafe condition to the surrounding properties and residence. Even though the direction of fire (in terms of elevation differential from the firing line to each of the target locations (5, 10, 25, 50 and 100 yards) is generally level or in a downward direction, this is not enough to assure accidental fire, ricochets or fragments are contained.
3. The existing firing line shed is not protective of users or accidental discharge.
4. The clubs 'Range Manual,' allowed ballistics and operating procedures is not complete.
5. Security around the clubs property is not substantial or delineated well enough to assure accidental entry.
6. The existing and proposed improvements are not sufficient to assure containment.
7. A more comprehensive containment system needs to be designed and implemented including side berms / baffles, overhead baffles, firing shed protection, bullet trap / berm, targeting systems (holders) and ground materials / berms / baffles. Sound and environmental issues need to be addressed, if desired, at this time also.

It is well understood that this situation is no doubt difficult to absorb or remedy. The sequence of events that have led to the proximity of live fire, adjacent properties / residences and city ordinances, while important, are not the concern of this report. Our work effort is to evaluate the existing conditions and react to (report) the situations with recommendations for the safety of life and the health of the gun range.



## Existing Conditions and Design Considerations

### Topographic / Vegetative Conditions

Vegetation is adequate to minimize erosion, not create hazards and allow for clear lines of sight. Topography is not adequate to contain ballistics at the vertical elevation above the Firing Line that the targets are currently located. Based on angles for incoming ballistics (angle of incidence), the average slope (%) from the firing line to the ridge and anticipated ballistic exit trajectory, the target firing shed and range needs to be modified.

### Soil / Ground Conditions

Acceptable condition, although environmental wetlands appears to be running across the range.

### Flat Targeting System / Holders

A better target holding system needs to be incorporated to assure secure placement of targets and to reduce the risk of ricochets and fragments.



The distance a bullet will travel varies according to several factors: ballistic coefficient, bullet weight, muzzle velocity, caliber, bullet shape, angle of muzzle elevation, and to a lesser degree, wind speed, wind direction and relative humidity. The ballistic coefficient and muzzle velocity are the two most important factors in determining the distance a bullet will travel. The following ballasting table has been modified for the use of this source book and is used with permission. Additional cartridges and newer projectiles have been added to the cart. The new cartridge data was derived by using Sierra Infinity v6ii. This chart should be used only as a quick reference to check comparative data for various calibers using specific bullet weight and velocities for planning purposes. The 30-06 (boattail) bullet, weight of 172 grains, muzzle velocity of 2,600 feet per second has been added to the chart and is shown to have a range of 5,500 yards or 3.12 miles, and does not mean that you have to own a control 3.12 miles of downrange area. Various factors can affect the maximum distance that a bullet or shot may travel. The tables below are to be considered as guidelines only.



**Chart A**

**Pistol**

Calculated Maximum ranges

Bullet Caliber/Name	Bullet Style	Bullet wt (grs.)	Assumed MV. (fps)	Calculated max. range (yards)	Calculated max. range (miles)
.22 Long Rifle	RN	40	1150	1922	1.09
.221 Rem. Fireball	PSP	50	2650	2666	1.51
.38 Special	STHP	110	1320	1800	1.02
.357 Magnum	JHP	158	1410	2366	1.34
.357 Sig	JHP	125	1350	1928	1.09
.38 Super	STHP	125	1280	2033	1.26
9mm Luger	FMJ	124	1140	1900	1.08
.40 S&W	JHP	180	1015	2093	1.89
.44 Rem. Mag	JSP	240	470	2500	1.42
.45 Auto	FMJ	230	945	1833	1.02
.45 Auto Rim	FMJ	230	810	1633	0.93
.45 Colt	LFN	255	860	1800	1.02

RN- Round Nose, PSP- Pointed Soft Point, STHP- Silvertip Hollow Point, JHP- Jackets Hollow Point, FMJ- Full Metal Jacket, JSP- Jacket Soft Point, LFN- Lead Flat Nose. Table updates 2011



**Chart B****Rifle**

Bullet Caliber/ Name	Bullet Style	Bullet wt. (grs)	Assumed MV. (fps)	Calculated max. range	
				(yards)	(miles)
222 Rem	PEP	50	3140	2500	1.42
223 Rem	FMJBT	55	3240	2766	1.57
22/250 Rem	E-tip	50	3810	2933	1.67
220 Swift	PEP	50	3870	2660	1.51
243 Win.	PP	100	2960	4000	2.27
243 Win.	PEP	80	3350	3500	1.99
250 Savage	ST	100	2820	3500	1.99
257 Roberts + P	PP	117	2780	3820	2.18
6.5 Creedmoor	SST	140	2850	5602	3.18
270 Win.	ST	130	3060	4000	2.27
270 Win.	PP	150	2850	4333	2.46
7mm Rem Mag	PP	175	2860	4933	2.80
280 Rem.	BST	140	3040	3700	2.10
300 Win Mag	PSPCL	150	3290	4028	2.29
300 Win Mag	PSPCL	180	2960	5202	2.96
308 Win.	PP	150	2820	4166	2.37
308 Win.	BTHP	168	2680	5157	2.93
308 Win.	ST	180	2620	4500	2.56
30-06 Spfld	ST	150	2910	4089	2.32
30-06 Spfld	FMJBT	172	2600	5500	3.12
8mm Mauser	PP	170	2360	2853	1.62
338 Win. Mag	PG	250	2650	5358	3.04
375 H&H Mag.	FS	270	2670	4688	2.66
45-70 Govt.	HPFN	300	1880	2453	1.39
458 Win.	SP	510	2040	3385	1.92

PEP (Positive Expanding Point), FMJBT (Full Metal Jacket Boat Tail), E-Tip Polymer Tip Lead Free, PP (Power Point), ST (Silvertip), SST (Super Shock Tip), BST (Ballistic Silvertip), PG (Partition Gold), FS (Fail Safe), SP (Soft Point), HPFN (Hollow Point Flat Nose). Table updated in 2011.



The following table lists standards distances for specific shooting activities. Note: Some distances used for special competitive activities, are optional and are duly noted. When in doubt, consult the appropriate rule book.

Smallbore Rifle, 50 feet, 50 yards, 50 meters, 100 yards (200 yards for special competition)

Highpower (Big bore/ centerfire) Rifle

- a. Conventional: 100, 200, 300, 500, 600 yards (800, 900 and 1,000 yards for special long range activities)
- b. International: 300 meters
- c. Bench Rest: 100, 200 yards. Some activities are conducted at 300 and 1,000 yards, but are the exception
- d. NRA Highpower Sport Rifle: 100 and 200 yards
- e. Police Qualifications: 100 and 200 yards





### Pistol

- a. Bullseye:  
Indoor and outdoor 50 feet and 25 yards  
Outdoor: 25 and 50 yards  
International/ UIT: 25 and 50 meters
- b. Police Combat: 7, 15, 25 and 50 yards
- c. Action Pistol: 7, 10, 25, 35 and 50 yards (different events may require different distances)
- d. Police Qualifications: Varies from 1 to 60 yards

### Silhouette

- a. Air Rifle: 20, 30, 36 and 45 yards
- b. Smallbore Rifle: 40, 60, 77 and 100 meters
- c. Highpower and Blackpowder cartridge: 200, 300, 385 and 500 meters
- d. Air Pistol: 10, 12.5, 15 and 18 yards
- e. Hunter's and Smallbore Pistol: 25, 50, 75 and 100 meters
- f. Long Range Pistol: 50, 100, 150 and 200 meters
- g. NMLRA Muzzleloading: 50, 100, 150 and 200 yards

### Muzzleloading

- a. Round ball: 25, 50, 100 and 200 yards
- b. Slug: 100 and 200 yards. (300, 600 and 1,000 yards for special events of



### Range Floor Contour (Grading)

- a. Material: The ground between the target and the firing line must be free of any hardened surface (smooth surface walkways, concrete and blacktop surface excepted), such as rock or other ricochet producing materials. The surface may be sodded or planted with low growing ground cover. The floor of the range can be concrete or blacktop. When projectiles hit concrete or blacktop at shallow angles such as a 20 degree or less, they have a tendency to follow the angle of the surface or rise at about 1-2 degree angle above the surface of the range floor.
- b. Configuration: Ideally, surface areas should be nearly level, sloping only enough to provide drainage. Slopes of 1-2 percent toward the targets, and 3 percent laterally, are ideal.
- c. Size: The overall size will be governed by the range distance and number of firing positions.



### Firing Line Cover

- a. Material: Firing line covers should be constructed using low maintenance materials, such as concrete floors, sheet metal covered walls, treated lumber, corrugated plastics, etc. Corrugated plastic or metal roofs without insulation are unsuitable because of noise reflection. These materials can be covered with spray-on acoustical material or by applying other acoustic material.

### Backstop/ Bullet Impact Berm

Various factors can affect the course, travel, deflection, bounce-back and ricochet of bullets or shot. The distance and measurements stated are to be considered as guidelines only. You may be held responsible for personal injury or property damage caused from any bullet or shot

that escapes the shooting range or that deflects, bounces back or ricochets, no matter how well your backstop, sideberms or baffles may be constructed.



### Main Backstop

- a. Materials: Main backstops may be natural hill or man-made earthwork, free of large rocks and debris to a depth of 18 to 24 inches. In areas where removing large rock is impractical, steel backstop and be used or material trucked in from backstop construction. Another method used in rocky areas is to build a backstop with fill dirt or wood cribs as core materials to minimize the cost

of trucking in clean soil to finish the project. Any broken core material, or cribs must be covered with a minimum of 18 to 24 inches of soil and maintained to that depth. Where soil conditions permit the construction of earth backstop or side berms, discarded material such as broken concrete, rock, asphalt, or bricks, may be used for the core or interior of the backstop or berm. This technique saves on the amount of clean fill required for surface treatment.

All Surface areas where bullets will strike are recommended to be free of large rock. Contact local agriculture agents if information on low, fast growing grasses common to the area to surface treat earthen backstops or berms. Crown vetch is a good choice in much of the United States, and it will aid in erosion control. Some areas of the country do not have enough available water to support ground cover.



NRA highly recommends that ranges DO NOT use railroad ties, stacked lumber or wood products for backstops. Bullets embedded in the wood can eventually cause lead buildup sufficient in size to cause backsplatter or bounce back of projectiles or particles, projectiles or particles can travel up to 50 yards straight back to the firing line with sufficient force to cause

personal injury or property damage

**CAUTION:** Exposed automobiles tires may cause bounce-back where ammunition velocities are below 800 fps. Highly recommend that no automobile or truck tires be used in backstop construction. The exception would be commercial or club built backstops using ground rubber tires or chunk rubber, ¾ to 2 inch in size, is acceptable. Keep in mind that the rubber normally settles on a 30 degree angle from horizontal and is stable. Provide proper drainage for the backstop. When utilizing with Geocell materials available today.



- b. Configuration: Sides should be sloped as steep as soil conditions

will allow. Shallow slopes may call for the installation of either a horizontal bullet catcher and/or a wall on top of the backstop to retain occasional ricochets. Most soils stabilize on about a 1.5-to-1 slope. Geocell materials may be used to aid with soil stabilization.

- c. Height: The recommended height for a backstop is 20 feet high, except where the down range area is backed up by high terrain features, such as a large hill or mountain, or by sufficient distance, to contain occasional ricochet. This is especially true with a 50 foot range, often used by youth shooting sports programs, where 10 feet is commonly recognized as the appropriate height. Where compaction procedures are not used, or do not work because of soil types, the fill material will settle, reducing the overall effective height. To counteract the condition, add additional fill as needed.



#### Side Berms/ Walls Around Each Target

- a. Material: Core material may be broken concrete, asphalt, rock- laden fill or other fill material discarded by area contractors. Exercise caution as local soil conservation district may restrict such use. Surface area subject to occasional bullet strikes should be rock and debris free to a depth of at least 12 inches. As an alternative to earthen sideberm, masonry walls may be used. When using masonry walls, they should be grout filled unless using solid block and designed for the prevalent wind load. Precast concrete wall panels offer a long-term use and ease of installation. They are generally less expensive than earthwork, and take up a much smaller footprint. Geocell materials may be used to build walls in areas where the soil is not stale such as sand.
- b. Configuration: Side berm need not be as high as the backstop, but they should have the same slope. For efficiency and cost savings, construct all berms as a single project. Install concrete walls vertically.
- c. Size: Earthen side berms suggest height is 8 feet.

**Caution:** Where soil conditions present a problem with compaction, additional material should be added to compensate for settlement. Wooden or concrete walls are recommended to be 8 feet high, and designed to stop all projectiles from penetrating the barrier.



#### Overhead Baffles

Overhead baffles are used to contain the flight of bullets to a specified area within the range. These overhead baffles are useful in areas where space is limited. Baffles are also described in sections on particular shooting activities (see drawings A/A-16, A-17, A-17, A-20, B/A-20, C7, C-9, C-24, C-25, C-26, C-28, C-29, C-62, C-70, C-71, C-72, C-73, C-74, C-75, C-76 and C-77). Other designs may be acceptable.

- a. **Material:** Construct baffles from a variety of materials, but make long-term low maintenance a design consideration. Reinforced concrete, steel, wood, and high-impact bullet-resistance plastic are some of the materials available.
- b. **Configuration:** Concrete panels should be pre-stressed, and a minimum of 6 inches thick. To interrupt or redirect the flight of errant projectiles, set concrete panels in place either vertically or at a 25 degree (see drawings C-24 and C-25). Width of these concrete slabs depends upon the local concrete contractors capabilities. NRA recommends the slabs be pre-stressed and have a 5,500 psi rating, especially when using rifle calibers.
- c. Wood and metal used in a “sandwich” configuration, with wood facing the shooter, allows bullets penetration to the metal, yet prevents backsplatter. The off-side if the baffle panel is covered with a thin later if wood to reduce sound generated by bullet strikes. Where sound is an issue, acoustical materials may be added to the face of the baffle.
- d. High impact clear plastic may be just as baffle material for some calibers in areas where the light is needed to improve visibility. Baffles using this type of construction are very expensive, may only take two or three projectile impacts, and may be sensitive to UV radiation from the sun

causing them to deteriorate over time. Such plastic prevents the escape of bullets and provides for natural illumination of the firing line area.

- e. Plywood can also be used for baffles. To do so, construct long boxes out of plywood and 2 x 6 inch lumber to be filled with a medium capable of stopping any bullet fired on the range, such as 3/4 inch crushed rock. Prior to baffle construction, select and test materials to be used in the baffle construction to determine effectiveness for bullet containment. In some cases, the baffle must be designed with 2 x 8 inch or 2 x 10 inch lumber. Test every designed to determine if it will stop the projectiles used at the range. If it fails, increase the baffle's depth until it can effectively stop and contain the projectile. This will also require engineering the support structure to handle the additional load.
- f. Baffles designed using dimension lumber and built (see drawing a – 16) are acceptable for pistol ranges. Recommend testing for baffle to ensure that projectiles will be contained.
  - You may add conveyor belting to the face of the baffle. This will reduce the velocity of the projectile, help protect the baffle, and will not be a reactive target for the shooter. As a projectile impacts the baffle, the remaining velocity and aerodynamic properties of the projectile change significantly.
  - Projectiles may travel the legal length of the property as long as they remain on property owned or controlled by the range.
- g. Size: overhead baffles must extend the entire width of the firing line and connect to either a sidewall or side between. \* Recommend concrete slabs be a minimum of 4 feet wide, 6 to 8 inches thick, , and have a 5500 PSI rating. Lengths up to 40 feet of pre-stressed concrete will increase the effectiveness of the range design and give a larger open area without obstruction from support structures. Built wood/steel laminated panels 16 feet long and 4 feet wide. Thickness depends on lamination required for a specific range. Do not forget to design baffles taking snow and/or wind loads into consideration.





#### Bullet catchers

- a. Material: Wood or concrete. Wood can be plywood, dimension lumber or railroad ties.
- b. Configuration: Install the catcher to provide maximum use of the exposed surface area. On earthen backstops, the horizontal bullet catcher is installed perpendicular (normal) to the slope. For training ranges, a horizontal bullet catcher build parallel to you, and 8 feet above the ground is acceptable.
- c. Size: Extend horizontal bullet catchers across the entire width of the target and project a minimum of 6 feet out from the face of the backstop.
- d. Bullet catchers may also be diagonal set at approximately 45 degrees from vertical leaning toward the firing line.
- e. You may also have a vertical bullet catcher which may be a wall constructed out of a variety of materials. The purpose of these assemblies is to contain, redirect or slow the projectile, so it remains on the property. The use of Geocell materials will allow the height of the backstop to be raised providing a vertical wall.



### Target frames/ Backers

- a. Material: Use soft pine, metal, cardboard, plastic or a combination of these materials to build target frames and backers. (See drawings A-30, A-31, A-40 and C-54.) Cardboard or other materials that allow bullets to pass through with minimum deflection is suitable for backing material. NRA recommends that you do not use plywood. It may leave splinters around the target area.
- b. Design: Target frames are generally rectangular or square.
- c. Size: Target frame size depends on the target being used. For example, the NRA bullseye pistol, the target frame must allow for a 21 x 24 inch size target; for highpower rifle, 4 x 6 feet at 200 and 300 yards; 6 x 6 feet at distances of 500 to 1,000 yards; and smallbore rifle, 14 inch wide and 42 inches high. Generally frames are sized to allow 2 to 3 inches of space around the edge of the target when a full face target is being used (smallbore rifle expected).  
**Important to remember:** All targets should be placed at a height such that the projectile goes through the target and impacts a backstop.
- d. These targeting areas should be better surrounded by earthen berms on all three sides. This will be accomplished when the targeting areas are lowered.
- e. These targeting areas should be equipped with an NRA approved backstop (see NRA Range Manual (3.04.5.1 (I-I-23) and 2.04 (II-2-8)) within these newly developed targeting areas.
- f. The firing line stations associated with these high-powered targeting areas (less than 100-yards) should be provided with safety baffles (at the firing line and down-range) to eliminate any “blue sky” being visible downrange. See NRA Range Manual 2.06 (II-2-12).
- g. A lid and back-stop system should be constructed at each targeting location (per NRA Range Manual recommendations) to help contain skipped or fragmented projectiles.

A sample of a more comprehensive range operations manual, existing property plans and existing range improvement diagrams are attached. Please see attachments "Sample Range Manual", "Existing Property Plans" and "Existing Property Plans".

If you have any further questions, please feel free to call.

Sincerely,

R Design Works



Rick LaRosa, NCARB, DBIA, LEED  
Principal

