WAGGA WAGGA
FOUR WHEEL DRIVE CLUB INC
"Living the Adventure!"

VEHICLE RECOVERY GUIDE

J. Kent *et al.* March 2020.

Disclaimer: These procedures have been developed as a guide to safe and efficient vehicle recovery. The author and Club cannot take responsibility for any loss, damage or injury incurred during recovery.

RESPONSIBILITIES

- All Club members are to follow standard safe and efficient procedures when recovering a stuck vehicle.
- Members must take responsibility for their own decisions and actions.
- If you are stuck, it is expected that you use your own recovery equipment.
- If you borrow equipment to recover your vehicle, you are responsible for any loss, damage or cleaning of that equipment.

VEHICLE RECOVERY STEPS

Step 1: **STOP.** Secure the vehicle to ensure it is safe. Do not rush.

Step 2: **ASSESS** the situation. Determine why it is stuck – e.g. check underneath.

Step 3: **DECIDE** the best option for recovery after considering the following *Hierarchy of Recovery*:

LOWEST RISK ↓	**Self-recovery (driving out)**	Lower tyre pressure. Clear around wheels. Build up tracks. Adjust driving technique. Fit wheel chains etc.
	Recovery boards or ladders	Use recovery boards or similar aids to provide traction and reduce rolling resistance in sand or mud, or to build bridges across ruts etc.
	Towing	Use another vehicle to gently tow the casualty (stuck) vehicle. Use adequately rated tow rope/strap, shackles and recovery points.
	Winching	All components must be adequately rated for the winching loads involved. *See below*.
	Jacking	Use an exhaust jack or high lift jack to lift a vehicle off an obstacle or allow filling in holes under a wheel. Vehicle MUST be secured and stable.
HIGHEST RISK	**Snatching**	Use the kinetic forces (stretch) of a snatch strap/s or recovery rope. All components (strap, vehicle mount points, shackles etc) must be adequately rated for the recovery loads involved. *See below.*

Step 4: **ALLOCATE TASKS:** If possible, have a recovery supervisor to oversee the operation and ensure safety at every step.

Step 5: **ESTABLISH COMMUNICATION:** Ensure all involved are clear on the communication method and any signals to be used. *See below*.

Step 6: **ENSURE SAFETY:** Double check all components in the recovery. Ensure by-standers are at a safe distance (e.g. 1.5 times the length of snatch straps, winch cables etc). Ensure nobody is within the Danger Zones. DO NOT use damaged or faulty equipment.

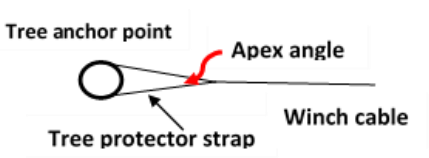
Step 7: **RECOVER THE VEHICLE:** Use the least amount of force necessary.

Step 8: **CHECK** the vehicle and recovery equipment for damage.

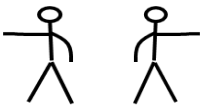
Step 9: **RESTORE** the vehicle to operating condition (e.g. reinflate tyres), pack away equipment and repair any track damage.

WINCHING

1. **ASSESS** the situation. Check why the vehicle is stuck e.g. hung up underneath. Clear any obstacles.
2. **CALCULATE** recovery loads to ensure Safe Working Limits of equipment are not exceeded.
   - Recovery loads depend on the weight of the loaded vehicle to be recovered, the gradient of the slope, and the type of ground. (*See Calculator*). Clear mud, sand etc from wheels or under the vehicle, or use recovery boards to reduce the loads.
   - If the amount of force required approaches the rated capacity of the winch, then use a pulley block to reduce the load. Remember the quoted rated load pulling capacity of a winch is the actual force placed on the winch cable.
   - Ensure all components (winch capacity, extension straps/chains/cables, shackles, anchor point etc) exceed the recovery loads involved.
   - Note that the pulling power of a winch decreases by about 10% with each layer of cable on the drum.
3. **SET UP:**
   - Ensure winch is operational and the cable is in good condition.
   - Ensure anchor points and the set up enable a straight line pull for the winch cable.
   - Ensure adequate wraps of cable on the winch drum (minimum 5 wraps for steel cable, 8 wraps for synthetic cable).
   - Reduce loads on the winch by using pulley blocks if possible/required, and/or recovery boards in sand or mud.
   - Ensure the anchor point will handle the load e.g. living tree at least 300mm diameter at waist height in good ground.
   - Use an adequately rated tree protection strap or padding to prevent damage to trees.
   - If a vehicle is to be the anchor point then have the engine running with foot firmly on the brake. If possible use a bridle (equalizing strap/tree protector strap) to spread the load.
   - When using a bridle or tree protector strap, it should be long enough to ensure the angle at the apex is less than 45 degrees to to reduce the loss of strength of the bridle/strap and to minimize side forces on the vehicle chassis and recovery points.



   - DO NOT USE A TOW BALL AS A RECOVERY POINT.
   - DO NOT use damaged or faulty cables, straps, chains etc.
4. **SAFETY:**
   - Appoint a recovery supervisor.
   - The recovery supervisor should keep an eye on all work and not actually do the setting up work.
   - Wear gloves when handling cables etc.
   - Place dampeners over cables etc at strategic points.
   - The winch control switch is to be disconnected and placed on the vehicle bonnet unless actually winching.
   - Keep bystanders and recovery supervisor at a safe distance and out of the danger zones.
   - As soon as the winch cable is connected to the recovery point, call “Winch live”.
   - No one is to step over a live winch cable.
   - The winch operator is to be in the winching vehicle.
   - Double check all components before winching.
5. **COMMUNICATION:**
   - Give the command “Clear winching” so everyone knows the winch operation is in progress.
   - Make sure the winch operator has a clear view of the recovery supervisor giving hand signals.
   - Hand signals are preferable to radio.
   - The following hand signals should be used.

Winch in	Circle hand raised above shoulder height.	
Winch out	Circle hand pointing down at waist height.	
Winch in/out bit by bit	Open and close fingers/thumb on raised or lowered hand.	
Steering direction	Hold arm out straight in direction in which to steer.	
Stop winching	Hold hands above shoulder height with palms facing the vehicle.	
Stop and secure vehicle	Raise arms above the head and grasp hands together.	

6. **OPERATION:**
   - Preferably do not drive the vehicle while winching to prevent cable over-runs (bird's nest) and shock loads on the winch and components.
   - Commence winching with the casualty vehicle in neutral and with the handbrake off. Run vehicle engine at 2000 – 2500 rpm to help keep the battery charged.
   - When the load comes on the winch cable, stop and check all components.
   - Winch duty cycles minimize heat build up and enable battery recharge:
     - STEEL CABLE – 30 seconds on, 30 seconds off.
     - SYNTHETIC CABLE – 15 seconds on, 30 seconds off.
   - Take it slowly and carefully. Check all components regularly e.g. connections, cable winding onto the winch drum.
7. **CHECK AND RESTORE:**
   - After winching wash and dry the cable and check it for damage.
   - Rewind the cable onto the drum under moderate load.

SNATCHING

Snatching is the most dangerous form of vehicle recovery. Safety is paramount. Snatching should only be used if other less risky options are not appropriate.

1 **ASSESS** the situation. Check why the vehicle is stuck e.g. hung up underneath. Clear any obstacles.

2 **CALCULATE** the recovery load (*see Calculator*). Recovery load depends on the weight of the loaded vehicle to be recovered, the gradient of the slope, and the type of ground. (*See Calculator*). Clear mud, sand etc from wheels or under the vehicle, or use recovery boards to reduce the loads. If the amount of force required approaches the rated capacity of the snatch strap, then do not attempt it – use a winch.

3 EQUIPMENT

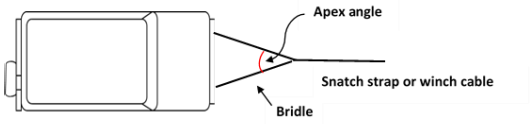
- Select a suitable recovery vehicle. Check vehicles for suitable recovery points.
- Use only adequately rated components (snatch strap, shackles, vehicle recovery points).
- The snatch strap used should be rated at 2-3 times the GVM of the lightest vehicle in the recovery operation e.g. if the lightest vehicle is 2,500kg (including load) then use a 7,500kg snatch strap. Bigger is not better.
- The snatch strap should be in good condition and dry if possible. Wet snatch straps have reduced elasticity. Do NOT use a damaged strap (it will have reduced strength).
- Rated bow shackles have a 5x safety margin before they break (therefore a 4.75t shackle breaks at about 23.75 tonne). Soft shackles do not have such a safety margin. Make sure shackles can be attached to recovery points.

4 SAFETY

- Appoint a recovery supervisor (can be one of the two drivers involved in the recovery operation).
- Determine danger zones in the area around and between the 2 vehicles and the intended path of travel. Bystanders and recovery supervisor to be at least 1.5 times the length of the strap/s away and not in the danger zone.
- When snatching, no person or animal to be in either vehicle other than the driver.

5 SET UP

- Determine the path and direction of recovery after considering track surface conditions (slippery, side slope angle, rocky, rutted, soft ground etc). If possible, line up the tow vehicle so there is a straight line pull with no obstacles in the way. The tow vehicle should be facing forward i.e. snatch strap connected to the rear hitch point.
- Check that the front wheels of both vehicles face the same direction.
- Position the recovery vehicle so that the strap can be connected to both vehicles with 1–2 metres of slack in the strap at the recovery vehicle end (less drag on the ground and the driver of the stuck vehicle can see it move). If two or more snatch straps need to be joined in series, join them correctly with a soft spacer in the strap eyes to prevent binding. NEVER JOIN STRAPS WITH A METAL BOW SHACKLE. If straps are joined, place slack in one strap only.
- Check that both vehicles have suitable, rated recovery points. NEVER USE A TOWBALL AS A RECOVERY POINT. Use the pin in the towbar hitch receiver or a purpose-made recovery insert in the towbar hitch receiver.
- If there are two suitable front recovery points, use a bridle (equalizing strap/tree protector strap) to spread the load. The bridle should be long enough to ensure the angle at the apex is less than 45 degrees to minimize side forces on the vehicle chassis and recovery points, and reduce the loss of strength of the bridle.



- Place dampeners over <u>both</u> ends of the snatch strap (plus one in the middle if you have 3). If only one dampener is available, place it at the end where a shackle is used. If no shackles are used, place the dampener in middle of the strap. Dampeners need to be weighted to be effective.
- The <u>last</u> step is to connect the strap to the recovery points on both vehicles Make sure there are no twists in the strap.
- Call “Strap live” to warn everyone that it is connected to both vehicles.
- No one is to step over the snatch strap when it is connected to the vehicles.

6 ESTABLISH COMMUNICATIONS

- Determine the signals to be used by drivers (horn, radio, lights, hand signals). Using the horn is best. It is recommended that the stuck vehicle toots the horn <u>twice</u> when ready (avoids potential mis-communication if only one toot is used). The recovery vehicle then drives off when they are ready, and the stuck vehicle toots <u>once</u> when it has regained traction.

7 RECOVER THE VEHICLE

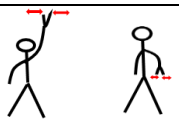
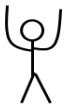
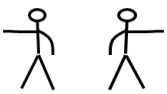
- Both vehicles need to be in the same gear and range/ratio in most situations e.g. 2nd gear low range.
- When ready, the driver of the stranded vehicle gives 2 toots of the horn.
- When ready, the recovering vehicle gently accelerates to take up the slack and stretch the strap. Try at low speeds (walking pace) first and no faster than 10–12 kph (fast jog). The stranded vehicle should assist the recovery by trying to drive out when the recovery vehicle moves off.
- If the recovery is not successful, try again with a little more speed. If not successful after 3 attempts with increasing pull, try another form of recovery.
- If the strap has been used 4-5 times in quick succession, rest that strap and use another strap (it has been stretched but will regain its original length over night).
- When the stranded vehicle regains traction, its driver signals as prearranged (one toot of the horn) and both vehicles come to a stop taking care not to run over the strap.

8 AFTER RECOVERY

- After recovery, secure vehicles and turn off engines.
- Check vehicles, recovery points and recovery equipment (including the strap) for damage.
- Repair any track/vehicle damage as appropriate.
- Wash the strap gently and dry in the shade.
- Destroy any strap that is damaged so it cannot be used.
- Destroy any strap that has been used for more than 5 to 8 recoveries or if the overload label indicators show that it has been overloaded. Record each recovery on the strap label with a pen/pencil.

GUIDING

- Use the following hand signals when guiding (spotting) a vehicle through an obstacle.

Drive straight forward	Raise hand/s above shoulder height and wave the vehicle forwards.	
Drive back straight	Lower hands below waist level and wave the vehicle backwards.	
Creep vehicle forward/back	Open and close fingers/thumb on raised or lowered hand.	
Stop vehicle	Hold hands above shoulder height with palms facing the vehicle.	
Steering direction	Hold arm out straight in direction in which to steer.	
Stop and secure vehicle	Raise arms above the head and grasp hands together.	

RECOVERY LOAD CALCULATOR

The amount of effort required to move a vehicle depends on three factors which add together:

1 The **VEHICLE WEIGHT** (vehicle plus its load). The heavier the vehicle the more force is required to move it.

2 The **ROLLING RESISTANCE** imposed on the vehicle due to the type and condition of the ground (mud, sand, rocks, ruts etc) and other factors resisting forward movement (e.g. tyre pressure). Rolling resistance is a percentage of the weight of the vehicle to be moved.

As an estimate:

TYPE OF GROUND	RESISTANCE FACTOR	APPROX. EFFORT REQUIRED TO MOVE VEHICLE ON FLAT GROUND			
		2500 kg vehicle	3000 kg vehicle	3500 kg vehicle	4000 kg vehicle
Hard surface	5%	125 kg	150 kg	175 kg	200 kg
Grass	15%	375 kg	450 kg	525 kg	600 kg
Wet hard sand	15 – 20%	500 kg	600 kg	700 kg	800 kg
Gravel	15 – 20%	500 kg	600 kg	700 kg	800 kg
Soft dry sand	25 – 35%	750 kg	900 kg	1050 kg	1200 kg
River stones	35%	875 kg	1050 kg	1225 kg	1400 kg
Shallow mud	35 - 50%	1250 kg	1500 kg	1750 kg	2000 kg
Deep mud	50 – 100%	2500 kg	3000 kg	3500 kg	4000 kg

3 The **GRADIENT RESISTANCE** (angle of incline or slope of the terrain at the recovery location not the whole hill). When a vehicle is on level ground you only need to overcome the rolling resistance to get it moving. As the angle of the gradient increases, so does the effort to move the vehicle up the incline. Measure the gradient at the stuck vehicle, not the entire slope.

To calculate the Gradient Resistance, divide the slope angle (in degrees) by 60 and multiply by the weight of the vehicle. As an estimate:

SLOPE	APPROX. EFFORT REQUIRED TO MOVE VEHICLE UP A SLOPE			
	2500 kg vehicle	3000 kg vehicle	3500 kg vehicle	4000 kg vehicle
10^0	420 kg	500 kg	585 kg	666 kg
15^0	625 kg	750 kg	875 kg	1000 kg
20^0	833 kg	1000 kg	1166 kg	1333 kg
30^0	1250 kg	1500 kg	1750 kg	2000 kg
40^0	1666 kg	2000 kg	2333 kg	2666 kg
50^0	2080 kg	2500 kg	2900 kg	3333 kg
60^0	2500 kg	3000 kg	3500 kg	4000 kg

TOTAL RECOVERY EFFORT REQUIRED = Rolling resistance + Gradient resistance

e.g. Total recovery effort for a 3000kg vehicle on a gravel slope of 30^0 = 600 + 1500 = 2100 kg.

Add a **10% safety margin**. Total force = 2100 + 210 = 2310 kg.

Note: This is the approximate amount of force placed on a tow rope, snatch strap or winch cable etc.

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