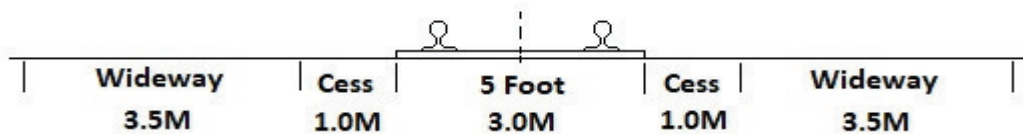


## **System Overview.**

The Modular weed spraying train has been designed to apply weed killer to the operational railway at the desired rate through a range of speeds. The system is user friendly, accurate and simple to operate using proven technology combined with high quality design and manufacturing skills. Water consumption is minimised using a Radiarc type spraying head which produces a rain type droplet that penetrates the plant canopy and reduces drift. The herbicide products (up to three) are automatically mixed as required during the application process and so unused chemical remains in its concentrated state within individual storage tanks. The system is also equipped with an automatic spot treatment system (Weed-It) which only applies a measured dose to individual weeds that are detected by the system infrared sensors. This system has a dedicated pre-mix storage tank. Five zones about the track centre line can be treated, these are – 'Five Foot', 'Left Cess', 'Right Cess', 'Left Wideway' & 'Right Wideway' (See application zones diagram).

### **Application zones diagram**



Application rates can be set to suit the products being used, the desired dosing rate and the water volume required. The system keeps these rates correct through the varying vehicle speeds and zone selection.

At the end of a spraying shift, the system is easily rinsed and shut down ready for the next shift.

When the vehicle is operating the Operator is positioned in the front cab and the spray application is applied from the rear of the front Bogie spraying heads. This reduces to a minimum the spray drift as the droplets are projected with the air flow.

The vehicle is equipped with four cameras (two mounted on each end of the Weedspray Module) & four monitors (two in each cab in the Operators Desk) which give the operators a view of the treatment applied at the track spray heads or selected wideway heads.

The system is supplied with water from two modules of three interconnected 3000 litre tanks mounted on the vehicle via interconnecting pipe work including a balance pipe between the two modules giving a total water volume of 18,000 litre tanks.

Both water tank modules should be fully replenished before the start of each shift to ensure maximum machine capacity & efficient operation of the equipment.

## **System overview cont'd.**

The modular weed spray system is constructed in a 20' ISO general purpose steel shipping container which has been modified and reduced in height (See Fig 1.1). The container is modified to include a personnel door at each end and two off updraft air intakes to ventilate the module. The container has a strengthened floor in the herbicide storage module & generator mounting positions, with the internal floor surfaces covered with aluminium tread plate flooring.

The container is fitted with a cooling air outlet louver & exhaust exit for the HGI Generator, this cooling air outlet louver arrangement uses the generator cooling system to induce cooling air into the container via the inlet air intakes in each personnel door.

All services into and from the weed spray module are routed through a removable service gland plate/bulkhead fitted at one rear corner of the module. This arrangement ensures all services are routed to the base vehicle in one contained area and all are of a quick release type fitting, both fluid & electrical (See Fig 1.2).

The module also contains First Aid Kits, PPE Locker, Spill Kit Locker, Portable replenishing equipment, Induction Hopper and Fire Extinguishers (x2). The module is fitted with internal strip lighting and two 115V sockets for power tools or replenishing pumps.



**1.1 Weed Spray Module**



**1.2 Fluid & Electrical Services Area**

## **System overview cont'd.**

The Weedspray Module electrical system is self-sufficient with electrical power supplied from a 12kVA WAC120H HGI Compact Welf-Air Upright diesel generator (See Fig 1.3). The generator has a built-in fuel tank of 195 litre capacity which is replenished via the front access doors (See Fig 1.4). With a full fuel tank, the generator has a run time of approximately 70hrs at 75% power.



**1.3 Diesel Generator**



**1.4 Fuel Filling Point**

The herbicide storage module (See Fig 1.5) comprises of one stainless steel fabricated module, divided into four tank compartments each having 400 litre (approx.) capacity. The module also houses the mounting structure for the herbicide dosing units, mixing manifold and Induction Hopper. Each tank compartment has a dedicated agitator unit for maintaining suspension of products when required. The storage module has a bund surrounding all four tank compartments and the herbicides dosing units.

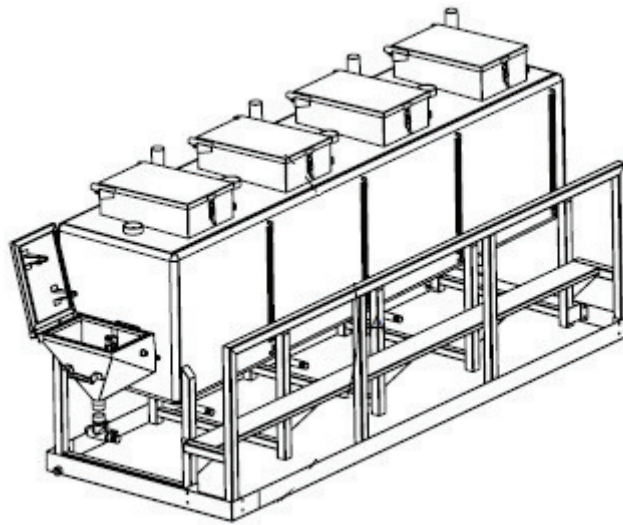
The tank compartments are replenished via external 115V replenishing pumps which can be powered from the Weedspray Module supply & draw the herbicide in from an external storage source. The replenishing pumps are supplied with quick release, dry break couplings to avoid spillage. The tank units are also fitted with the same type couplings to enable closed transfer of the herbicide products (See Fig 1.6).

The tanks can be emptied via the tank isolation valves & dry break couplers. The drained contents being piped using the supplied replenishing hoses to an approved external storage or washings container (See Fig 1.8).

Each tank compartment has a rinsing system built into the compartment which uses clean water from the main water system (See Fig 1.7). This allows washing down of the tanks internally for herbicide changes or maintenance.

The herbicide storage module has four access lids for each tank compartment, to allow access to the tanks.

## System overview cont'd.



**1.5 Herbicide Storage Module**



**1.6 Replenishing Point**



**1.7 Tank Wash Point**



**1.8 Tank Control Valve**



## **System overview cont'd.**

The main herbicide dosing system is a Raven Direct Injection system which only uses the required amount of chemical while the machine is spraying, so the need for tank mixing is not required. This ensures that the herbicides are kept in their neat undiluted state within the storage module and water remains un-contaminated within the water tanks.

The control systems are designed to simplify sprayer operations by providing speed compensated product application regardless of the vehicle speed, while adjusting for the width and status of the programmed Radiarc swath sections and a target rate set by the operator. The Operator has a Viper 4 console in each cab, with an interlock system that only allows one console to be in operation at any one time. This interlock system is controlled by a console key system selected by the Operator (See Fig 1.8).



### **1.9 Viper 4 & Weed-It Operator Console, Controls & Key Selector**

Raven control systems improve the uniformity of product coverage for up to four liquids ((x1) carrier & (x3) chemical injection) products via product control nodes connected to a CAN (Controller Area Network).

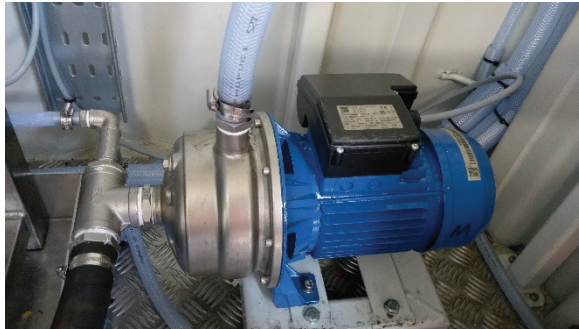
The Operator sets the target application rate for each product to be controlled by the Viper 4 console. Simply activates the boom controls to the on positions and go. The console and product control nodes adjust the control valves to the target application rate regardless of vehicle speed.

During product application, the Viper 4 console also functions as an area monitor, speed monitor, and volume totalizer, the actual volume per area is displayed for each product that the Operator has selected.

The unit is also provided with an Infrared Spot Treatment (Weed-It) system that detects chlorophyll in the target weeds and applies a measured dose to treat the individual weed growths. The Operator has a second console (See Fig 1.9) to control the Weed-It system with a simple control system that allows the Operator once selected to leave the system to treat throughout the shift without intervention of control.

## **System overview cont'd.**

The water (Product 1) is supplied to the system from the water tanks via an electric powered centrifugal pump located in the Weedspray Module (See Fig 2.0). The pump inlet is protected by a 'Y' type inlet filter, the pump outlet pressure is set by a Nocton pressure regulating set (See Fig 2.1) and the water is pumped onto the (x2) mixing manifold/injection points (See Fig 2.0).

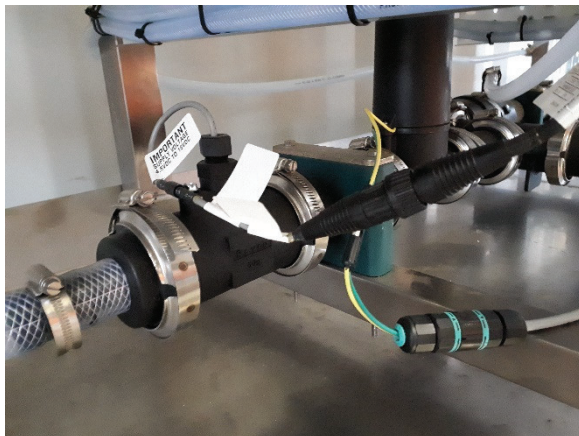


**2.0 Centrifugal Water Pump**



**2.1 Nocton Pressure Regulator**

The water flow rate and pressure are monitored by the injection system via feedback from a flow meter & pressure transducer in the system. The water flow is controlled by a flow control butterfly valve which is operated according to the flow required (See Fig 2.2 & 2.3). The water passes through a non-return valve before the herbicide injection point which ensures herbicide cannot back feed into the clean water system.



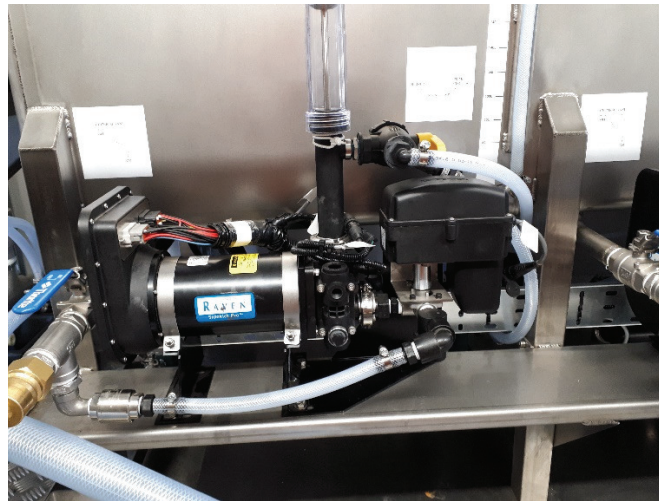
**2.2 Flow Meter & Control Valve**



**2.3 Pressure Transducer**

## **System overview cont'd.**

The herbicide products (Products 2-4) are drawn from the respective tank compartment of the storage module via the tank isolator valves and pass through a small suction filter. The flow of product to the injection point of the mixing manifold is controlled by dosing units which pump the required amount of herbicide dependant on operator settings & vehicle speed (See Fig 2.4).



### **2.4 Dosing Unit**

The flow rate is monitored by an internal flow meter & pressure transducer within the dosing unit. Each product passes through a non-return valve before the injection point which ensures water cannot back feed into the herbicide storage tanks.

The water & injected herbicides pass through an in-line mixer unit which ensures the herbicide is mixed thoroughly with the water in the mixing manifold ready for application to the spray areas selected (See Fig 2.5).

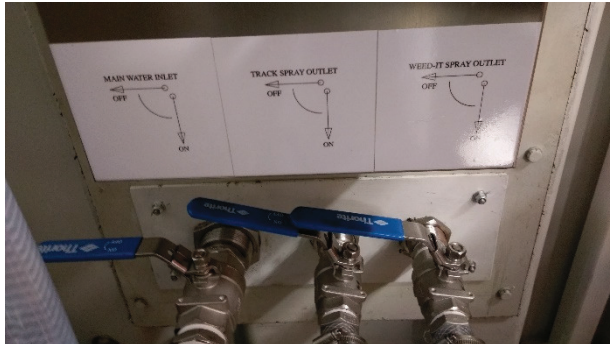


### **2.5 In-Line Mixer & Non-Return Valves**



## **System overview cont'd.**

When the Water/herbicide dosing process is completed within the Weedspray Module the water/herbicide mix passes through a track spray isolator valve (See Fig 2.6). The fluid is then routed via flexible hoses on the outside of the module down to the vehicle rigid pipe routes that supply the spray heads. The flexible fluid pipes have colour coded markings to ensure correct connections and fluid routing (See Fig 2.7).



**2.6 Track Spray Isolator (Centre)**



**2.7 Flexible Hose Colour Coding**

The water/herbicide mix is piped to each end of the vehicle and supplied to the selected spray head via a flow control valve for each head. The Radiarc spray head and flow control valve are energised when the Operator selects that spray area within the application zones (See Fig 2.8). This allows the flow of fluid to the spray head and the spray head starts to oscillate to produce the correct spray droplets (See Fig 2.9).



**2.8 Flow Control Valve & Spray Head**

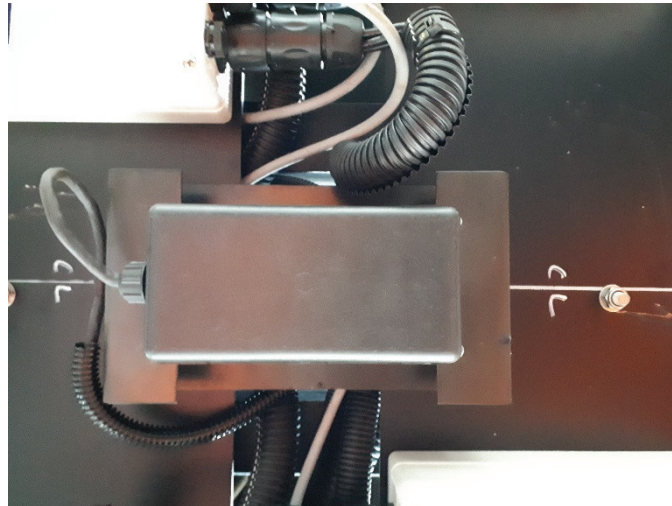


**2.9 Radiarc Spray Head Operation**



## **System overview cont'd.**

The Raven Viper 4 control system detects vehicle speed via a Doppler Radar Speed Sensor which gives accurate vehicle speed throughout the specified operating range of 5 – 48km/h. The Radar Speed Sensor unit is fitted on the Weed-It frame under the weedspray module. The other console not in use is de-energised via the Operators console selection key interlock. The radar unit is fitted on a robust mounting bracket at a specified height from the track (See Fig 2.8).

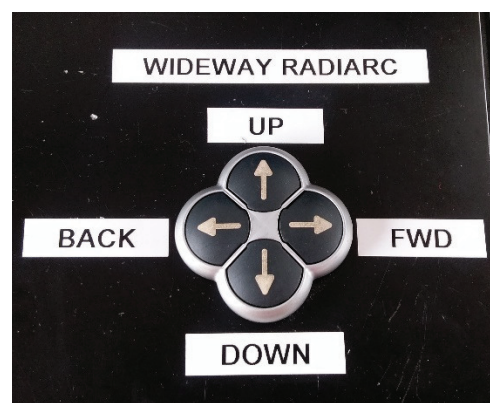


**2.8 Radar Speed Sensor**

The Raven Viper 4 system also controls the Wideway spraying system which allows the Operator to spray either left or right Wideway in the direction of travel. The Operator also has the option to pan or tilt the Wideway Radiarc head (See Fig 2.9) to trim the spray pattern to suit the track/wideway layout. The Operator controls the pan and tilt via a control desk directional pad (See Fig 3.0).



**2.9 Wideway Radiarc**



**3.0 Directional Control Pad**

## **System overview cont'd.**

The Weed-It System fitted to the machine consists of Sensor and Nozzle combinations to spot and treat individual weed growths at 0-48km/h treatment speeds. The main equipment is mounted on a Weed-It frame mounted under the Weedspray Module nearest to Cab 'B' end of the vehicle (See Fig 3.1). The sensor banks mounted on the frame front detect chlorophyll within the weed and activate the appropriate nozzle in the rear nozzle bank to spray the weed growth with a measured dose of pre-mixed Water/Herbicide mix (See Fig 3.2).

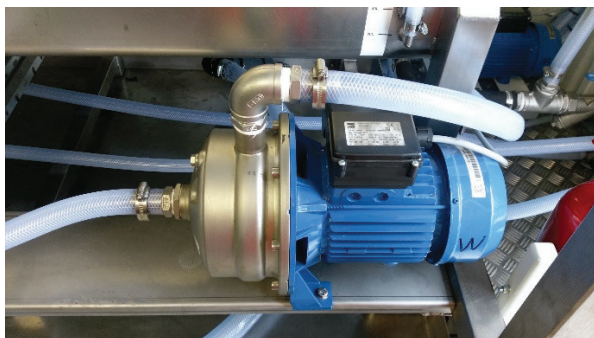


**3.1 Weed-It Unit Location**



**3.2 Sensor & Nozzle Configuration**

The Water Herbicide tank mix is stored in a dedicated tank within the Tank Module which is designated 'Product 5 Weed-It'. This tank has a dedicated centrifugal pump and Nocton pressure set which recirculates the tank mix until nozzles activate to use the water herbicide mix (See Fig 3.3). The Operator controls the Weed-It system with the Weed-It console within each cab, which only requires the Operator to power up the system and check for faults at the start of the shift. During the shift the Operator only has to monitor for faults as the Weed-It system will treat any weed growth within the treatment area automatically without Operator intervention (See Fig 3.4).



**3.3 Weed-It Pump**



**3.4 Weed-It Console (Left)**