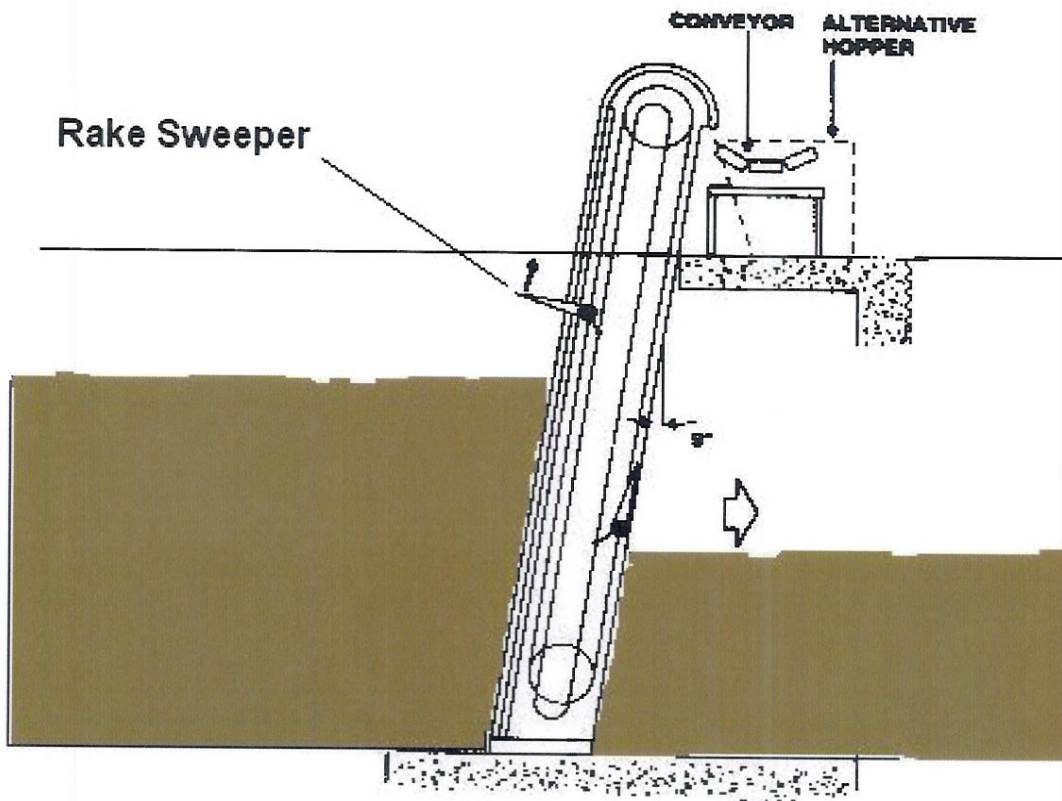


## ***Dept. 895 Control Technician Report TVRWF Raw Sewage Spill 12/25/09***

*Bob Naranjo employee 1651*

### ***Cause of the Spill***

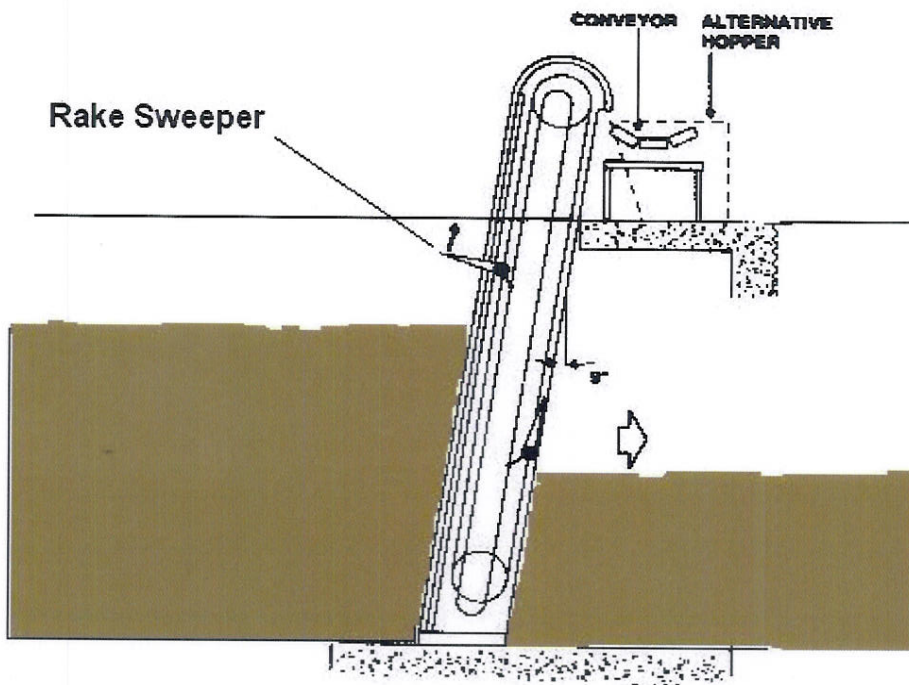
About 2 yrs. ago, the Plant installed 2 new Bar Screen machines, as an upgrade project, replacing the less effective Grinder/Auger. The Bar Screens remove larger debris and objects that can get caught or bind other machinery as the sewage is processed. It is the first thing done when the sewage arrives at the Plant.



**Side View**

[Barscreen Video](#)

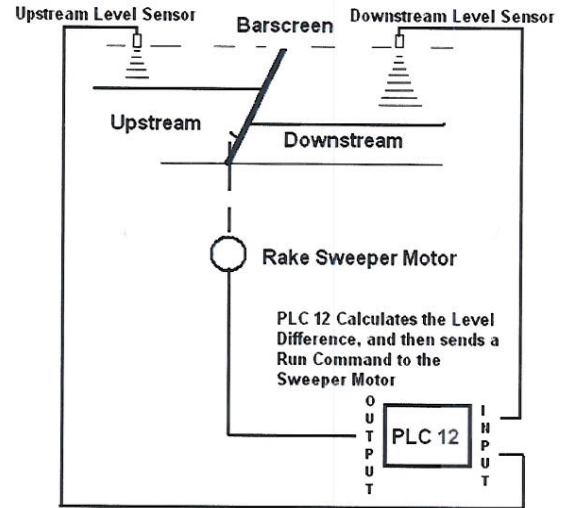
Sewage flows to the influent structure, and into 2 shallow channels. The Barscreen machines are installed in the channels. Debris is captured on the bars, clogging the flow across the channel. As the upstream level increases, the downstream level decreases due to the clogged grate. The level sensors detect this differential level, and activate the sweeper motor, sweeping clear the trapped debris. The debris is swept onto a conveyor which carries it away. When the levels equalize across the bars, the motor shuts off, and the cycle is complete, awaiting for the grate to clog again. Failure to sweep the grates will result in a sewage spill, so typically there are redundant controls to assure the grates **always** remain cleared. During periods of high flow, the sweeper rake will often remain running.



**Side View**



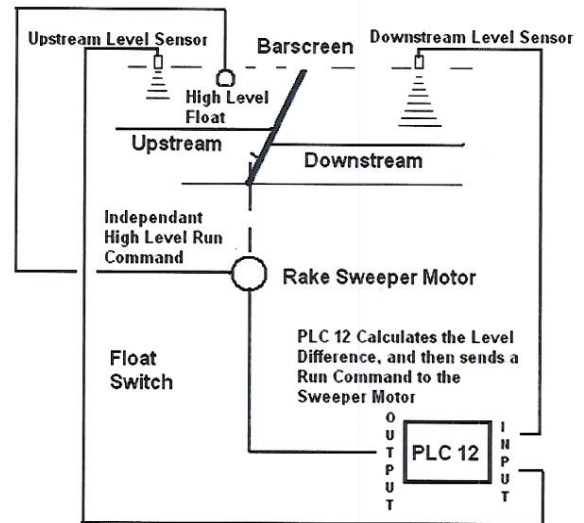
The Barscreens were installed with Programmable Logic Controller (PLC) 12 being the **only** source commanding the Sweeper Rakes to run. This design flaw makes PLC 12 a common denominator for both machines. If PLC 12 fails, **both** Barscreens will lose their run command. This is precisely what happened. Although both Barscreens were fully functional, PLC 12 faulted, disabling both machines



**Flawed Design**

### Design Improvement

Typically, barscreens have an additional high level override float switches, hardwired directly to the motor controls, so if the electronic level sensors malfunction, or if the PLC fails, the Float switches will override and turn the machines on independently.



**Design Improvement**

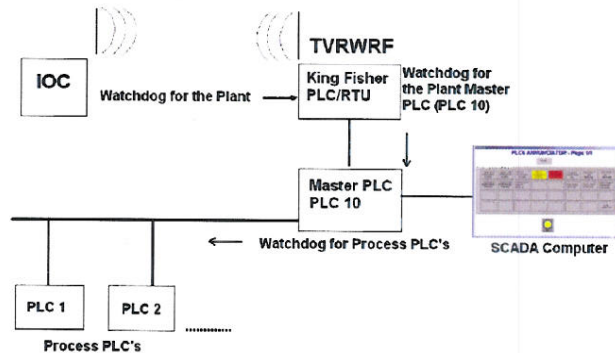
### Action Item # 1 (Done)

Install High Level Floats, one for each machine, providing independent overriding control. They will turn on, and sweep the rakes if the level in the channel becomes unacceptably high. This would have prevented the spill.

## PLC/SCADA Overview

Like other Wastewater Plants of similar size and scope, TVRWRF relies on Programmable Logic Controllers (PLC's) for automated operation of the plant. The PLC's exchange data with two Supervisory Control and Data Acquisition computers (SCADA), which provide a graphical interface for plant operators, report alarm conditions both locally and to the IOC, and record plant data, conditions, and events.

The PLC's use "watchdog" timers, to ensure all the PLC's are functioning correctly. It works like a chain, so if any of the links malfunction, the IOC will be notified. The Wastewater Plants use industry standard Allen Bradley PLC's to automate the plant. They perform well, however like anything else, they can malfunction.



### Communication Chain

IOC is notified if any link is broken

As forementioned, PLC 12 malfunctioned (faulted), and the Watchdog PLC (PLC 10) reported the failure to the IOC at 15:40 12/25/09. The IOC contacted the on-call operator immediately, and the operator was already logged into Scada remotely from home. The on-call operator acknowledged the 1st page of PLC12, however failed to check page 3, where the PLC Failure alarm was flashing red. This would have prompted the him to dispatch a Control Technician to resolve the faulted PLC 12.

```

15:41:30.5 [AWT1 ] YIC12_COMM_FAIL      CFN  FAIL      YIC12 ALARM STATION COMM FAIL
15:41:30.5 [AWT1 ] DISPATCH_ALARM      CFN  ACTIVE    A DISPATCH ALARM IS ACTIVE
15:41:30.5 [AWT1 ] TELEMETRY_ALARM     CFN  CALLOUT   A DISPATCH ALARM IS ACTIVE FOR
SCADALARM
15:42:10.7 JAMES KING logged in as Application User
15:42:17.5 [AWT1 ] YIC12_ALM_ACK.F_0 set to 1.000 by AWT3::1811
15:42:18.3 [AWT1 ] YIC12_COMMFAIL_ACK.F_0 set to 1.000 by AWT3::1811
15:51:30.5 [AWT1 ] DISPATCH_ALARM      OK   OFF       A DISPATCH ALARM IS ACTIVE
15:51:30.5 [AWT1 ] TELEMETRY_ALARM     OK   OFF       A DISPATCH ALARM IS ACTIVE FOR
SCADALARM
16:02:11.1 Login Timed Out of Application User JAMES KING
  
```



Another design flaw, from the original installation by Beavens Systems (the Contractor who installed the Scada system in Aug 1999), allowed PLC failure alarms to be acknowledged on the SCADA computer, thus releasing the dispatch warning going to the IOC. This is precisely what happened on 12/25/09.

PLC failure alarms are such, that no acknowledge, or release should be available. Review of the other Treatment Plants (San Jacinto, Moreno, and Perris) discovered that PLC failure alarms **cannot** be released, or acknowledged from the Alarm page, and the IOC will remain dispatched until the PLC is repaired. For whatever reason, Temecula was configured differently.

Additionally, it was discovered that a lack of training, lack of redundant visual cues (there should have been an additional PLC 12 failure visual indicator on the Headworks Machinery page), misled Mr. King to believe that the Bar screens were functioning correctly.

There were also a series of nuisance alarms, that led Mr. King into believing the alarm he was responding to at 15:40 12/25/09, was with problematic equipment that had failed earlier in the day, posing no threat to the Plant.

Critical alarms with no acknowledge option, alarm screens that force operators to view **all** alarm events, additional visual indicators on machinery pages, and better training of operations staff on the Scada system, **could** all have prevented the spill.

#### Action Item # 2 (Done)

Re-program all PLC Fail Alarms at Temecula, so they cannot be acknowledged or released from IOC dispatch.

#### Action Item # 3 (Done)

Configure alarm pages, so that acknowledge button is located on the last page. Operators are forced to review all alarm pages before they can access the acknowledge button. Notify Beavens Systems new annunciator panels in future expansions must be configured the same

#### Action Item # 4 (Done)

Nomenclature. Add additional visual indicators on Machinery pages. There are several terms that have transcended from the past, that no longer apply, creating confusion among staff. Standardize terminology on Scada pages. Suggest more training be provided to operations staff regarding Scada System.