

TORO[®] SENTINEL[®] APPLICATION NOTE

AN05: SCHEDULER / OPTIMIZER



SCHEDULER / OPTIMIZER IN SENTINEL

Scheduler / Optimizer Overview

The **Scheduler** button in The Sentinel Main Toolbar opens the Flow Optimizer/Scheduler window which is used to optimize Program starts based on demand and flow limit without changing station order within the Program.

😵 Ser	ntinel WMS	8 - Your Organization				
Main M	lenu Win	dow Com	munic	ations		
۵	*	٩,		<u> </u>		
Setup	Manage	Scheduler	Log	Turf Guard		

The Scheduler/Optimizer allows Sentinel WMS to assign start times for programs with the Auto Schedule Start option selected. The Scheduler/Optimizer will attempt to schedule irrigation to occur in one continuous block, or as close to a continuous block as possible within the defined constraints (Water Window and Total Flow). The Auto Schedule Start option is selected in Automatic Operations and must be selected for each program that will be managed by the Scheduler/Optimizer. To work properly, programs using Auto Schedule Start must have a valid Water Window defined and no Start Time defined. This will allow Sentinel WMS to determine when the program should start in order to finish on time (before end of Water Window). Programs that need to water at a specific time can be given a start time and the Scheduler/Optimizer will leave them alone; these programs cannot have the Auto Schedule Start option selected.

Scheduler / Optimizer Setup

For Programs to be Optimized:

- 1. No Start Times should be set.
- 2. A Water Window in which the Program should run must be defined.
- 3. Auto Schedule Start must be selected (checked)

🔡 Program 100-	[Toro Demo Controller] - [A2]	×			
🚽 Checkup 🛛 🜷 Re	eceive 🛧 Send 📕 Save 🧟 Refresh 🗏 Description 🗞 Erase 🔞 Help 🚔 Print 🔀 Clo	ose			
🎇A1 🍕 🔍 A3	3 • A4 • B1 • B2 • B3 • B4 • C1 • C2 • C3 • C4 • D1 • D2 • D3 • C	04			
Start Times 1	Water Window Continuous Continuous Water Window Continuous Schedule Tvoe Schedule Tvoe Cycle Delay 0 + To Image: Selected Schedule Schedule 1 Continuous Ru Schedule Schedule Schedule 1 Image: Selected Schedule Activate auxiliary pum Selected Schedule Wk Image: Selected Schedule Auto Schedule Start 1 - Image: Selected Schedule Volumetric shutdow 1 - Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule Wk Image: Selected Schedule Image: Selected Schedule Image: Selected Schedule				
	program ok wk water window duration is entire day start duration 00:00 water usage per run day = 0 (gal) Apply pattern (click to upde:				
Slots - Station order and run times for one cycle.					
🔎 Station Search	🔌 Clear Slots 📑 Compact 💠 Editor 🔘 Start Now 🧿 Stop Now				

For Any Zone/Station in the "Program to be Scheduled/Optimized":

4. Expected Flow should be set in Zone Data (if flow constraints are to be used)

🛃 Z	one Data	100-	[Toro [Demo Controll	er]	_ 🗆 🗙
& P ⊠S ⊒L	Receive 🔞 Retup Loca Rearn Curre	Nend I <mark>⊠</mark> S ent <u>ठ</u>	etup Wir Excel	/e 🧖 Refresh reless 🔽 Setup ⊠ Close	🚔 Print 🕨 Hide o Toro 2-Wire 🛃	/Show Editor Setup BL
Sho Stn.	w/Hide Co Mapping	lumn (Curre	Groups - nt All C	 Descriptions Columns 	Flow ET Calcu	ulations Soil Data
Dra	ig a colum	n head	der here	to group by the	at column.	
Stn 1	Exp. 4 Flow	Min. Flow	Max. Flow	Flow Zone	In Programs	
	Zone	Data	- 100- [Toro Demo Con	troller]	
1	3	0	0		A1	
2	0	0	0			
3	U	0	U 0			
4	0	0	0			
6	0	0	0			
7	0	0	0			
8	0	0	0			
9	0	0	0			
10	0	0	0			

For any Satellite with Programs to be Scheduled/Optimized:

5. The Satellite must be Assigned to a System (via **Manage** on the Main Toolbar).

💥 Manage - systems and units		
Systems	⊂System Toro Riverside contents	Master List (all units in database)
* Toro Riverside	100-Toro Demo Controller	100-Toro Demo Controller 200-Test Unit
		140
1		

To use Scheduler / Optimizer

6. Click on Scheduler in the Sentinel Main Toolbar.

🚱 Sentinel WM	S - Your Org	ganization
Main Menu 🛛 Win	dow Comm	nunications
🌼 💥	🍦 🧕 🙆	🗅 🙇 [
Setup Manage	Scheduler	og Turf Guard

Scheduler / Optimizer Settings & Options

Scheduler / Optimizer		
🕥 Schedule / Optimize 🛛 🥘 Cancel Optimizer 🛛 🌆 Sh	iow Graph 🛛 🛄 Flow Zones 🛛 🔀 Exit	
Initial target System to schedule / optimize A1 I A Enable Program Filter>>	Include 22 IF A3 IF A4 IF B1 IF B2 IF B3 I 22 IF C3 IF C4 IF D1 IF D2 IF D3 I	B4 clear all D4 set all
Settings Start of Irrigation 4:43 PM C Today Tomorrow When choosing start, allow sufficent time for all irrigation to complete before units cross day change time.	Optimization Constraints Total flow constraint (GPM) Use flow zones	Operational Preferences
Status Current State: Off Time under test: Total Schedule Attempts: 0 Max Sta Besults	Elapsed Time 0 ations: 0 Total Flow: 0	Total Programs Scheduled: 0 Flow Zones: 0 To Schedule: Pre-Scheduled: Scheduled

Initial Target

System to schedule / optimize - Select the System that contains the units that will be Scheduled/Optimized. Units must be added to a system in order to be considered by the Scheduler/Optimizer.

Clicking **Enable Program Filter** will allow for selection of only programs that need to be scheduled. Unchecked programs will not be evaluated during the scheduling process.

Settings

Start of Irrigation - The Start of Irrigation time should be set for at least one minute before the earliest Water Window begins. Today or Tomorrow should be selected based on when the irrigation will run based on the defined Change of Day. For example, if the change of day has not yet occurred, and the irrigation is going to run after the change of day takes place, Tomorrow should be selected. If the change of day has already occurred, and the irrigation is scheduled to run before the next change of day, Today should be selected.

Optimization Constraints - The Scheduler/Optimizer can schedule watering that doesn't exceed a total flow, or that doesn't exceed the defined flow of hydraulic tree. Zone Data must be populated with an Expected Flow value for this function to work. Flow Zones must be defined (accessible through the Flow Zones button in Scheduler/Optimizer) if Use flow zones is selected.

Operational Preferences - By default, Use adaptive step size (faster) will be selected. If scheduling fails with this option selected, try running the Scheduler again with the option turned off.

<u>Status</u>

Current State - If the Scheduler/Optimizer successfully completes the Current State will show Finished with a green background. If it fails to schedule the Current State will show Finished with a red background.

Statistics about the Schedule/Optimization process are displayed under Status, such as how long the Scheduler took to complete (or how long is has been running if it has not completed), the number of attempts it has made, and constraints that were supplied for the process.

Results

Scheduling results are displayed, such as what times were assigned to each program and which units and programs were scheduled, and any programs that were pre-scheduled (a start time was defined in the program, so the Scheduler did not change it).

Example of a successfully completed Scheduler/Optimizer using a 25gpm flow constraint:

😓 Scheduler / Optimizer						
Ď Schedule / Optimize 🛛 🧿 Cancel Optimize	r 🛛 🌆 Show Graph	Flow Zones 🛛 🛛	Exit			
Initial target System to schedule / optimize Toro Enable Program Filter>>	ograms⊺olnclude − A1 Γ A2 Γ A3 C1 Γ C2 Γ C3	□ A4 □ B1 □ E □ C4 □ D1 □ E	32 〒 B3 〒 B4 D2 〒 D3 〒 D4	4 <u>clear all</u> 4 <u>set all</u>		
Start of Irrigation 4:32 PM C Today Tomo When choosing start, allow sufficent time f irrigation to complete before units cross da time.	orrow or all y change	Optimization Constr Total flow constr 25 ÷ Use flow zones	aints aint] (GPM)	Operational P	references	
Status Current State: Finished Time under te: Total Schedule Attempts: 0	st: 1/20/2011 8:15 Max Stations: 0	AM Elapsed T Total Flow:	Time 00:00:09	Total Progra Flow Zones:	ms Scheduled:	1
Results		U	nits: To S	Schedule:	Pre-Scheduled:	Scheduled:
Scheduled unit 001, program A1, starting at 1 Scheduling operation complete.	/20/2011 8:03:00 Ał	M	01			001:A1

The updated schedule must be sent to all affected satellites in the system after successfully running the Scheduler/Optimizer.

- 1. Click **Exit** to apply the changes to the database.
- 2. Open Unsent Changes for the System that was scheduled.
- 3. Click Send.

Graphing

🔩 Scheduler / Optimizer		izer	
🔘 Schedule / Optimize 🤘 Cancel Optimizer	🏥 Show Graph 🛄 Flow Zones 🛛 Exit	🧿 Cancel Optimizer	🔀 Eixit

The Show Graph button will show a water usage graph using theoretical flow based on the expected flow values provided in Zone Data. Each day is shown in alternating white/blue blocks. Theoretical flow is displayed using a blue line. Actual flow data will be displayed using a green line, if it is available (water meter required).



Utilizing Flow Zones



Flow Zone Manager

To access the Flow Zone Manager, click the Flow Zones button at the top of the Scheduler/Optimizer. By default, there are no flow zones or sources defined.

Add new flow source
2

The **Add new flow source button** will add a flow source to the tree. To create a flow source, you must enter the description (name for the source) and the Maximum flow (the maximum flow capability in gallons per minute, liters per minute, or cubic meters per hour $[m^3/hr]$ based on Units setting).

City water source added with max now of 130gpm	City	/ Water	Source	added	with	max	flow	of	150gpm:
--	------	---------	--------	-------	------	-----	------	----	---------

Flow Zones	
🔤 City Water Feed[150]	Add new flow zone
	Description:
	City Water Feed
	Maximum flow: 150
	😑 Add new branch flow zone
	Add new flow source

The **Add new branch flow zone** button will add pipes (children) below whatever source or flow zone (parent) is selected when the button is pressed. As with the Add new flow source button, the description and maximum flow for the pipe must be entered before the Add new branch flow zone button is pressed. Each child pipe will not exceed the flow of its parent pipe, and the total flow will never exceed the defined maximum flow for the parent flow source. This is used in the Scheduler/Optimizer to determine the maximum number of stations that can be run in any area when using Total flow constraints with flow zones.

III Flow Zone Manager	_ 🗆 🖂
Flow Zones	Add new flow zone Description: City Park #1 Maximum flow: 75 Add new branch flow zone Add new flow source

After creating the flow zones, stations must be assigned to their appropriate branches in Zone Data:

1. In Satellite **Special Data > Scheduler Tab**, Select the **Top-most flow zone** for the Satellite (this would be the flow zone that fully encompasses the Satellite's stations.

🖳 Special Data 100- [Toro Demo Controller]						
🕹 Receive 🎓 Send 🗐 Save 🧟 Refresh 🔯 Close						
🕕 General 😒 Global 🥝 Flow Meter 🍄 Alarm Input 🖨 Field Modem 🍶 Pump / MV 🗱 ET 📝 Current 🔜						
Top-most flow zone:						
Toro Riverside P.O.C.						
Front Parking Lot Drip System						
Front Entry Sprays						
Northern Lawn Sprays						
NL Walkway Sprays						
NL Building Side Sprays						

2. In **Satellite > Zone Data**, select the appropriate **Flow Zone** for each station, then **Save** and **Send** the updated data.

🖳 Zone Data 100- [Toro Demo Controller]							
👃 Receive 👌 Send 📕 Save 🧟 Refresh 🚔 Print 🕨 Hide/Show Editor							
🗹 Setup Local 🔽 Setup Wireless 🔽 Setup Toro 2-Wire 🔽 Setup BL							
🔄 Learn Current 🍝 Excel 🛛 Close							
Show/Hide Column Groups -> Descriptions Flow FT Calculations, Soil Data							
Ste Menning Current All Columns							
Drag a column header here to group by that column.							
Stn	Exp.	Min.	Max.	Flow Zone	In Programs		
•	Flow	Flow	Flow				
Zone Data - 100- (Toro Demo Con roller)							
1	3	0	0		A1		
2	0	0	C				
3	0	0	C	Front Entry Sprays			
4	0	0	C	Front Lawn Rotors			
5	0	0	C	Front Parking Lot Drip			
6	0	0	C	INL Building Side Sprays			
7	0	0	C	Northern Lawn Sprays			
8	0	0	C	Toro Riverside P.O.Ć.			
9	0	0	0				

You can now Run Scheduler / Optimizer for Flow Optimization.

