



**IPM = ?**



Natural Systems vs. Urbanized Systems



**Presentation outline:**

1. Sound Transit Primer
2. Agency Sustainability Program
3. Water Use Reduction Strategy
4. Irrigation Assessment Example
5. Lessons-Learned



**The Sound Transit district**

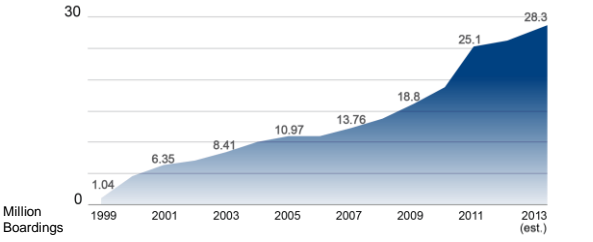
Map Key:  
 ST Express rapid bus  
 Sounder commuter rail  
 Link light rail  
 Stations and parking



**Making it easier to get around**



**Serving more riders each year**



### Tacoma Link Light Rail

- Opened in 2003
- Approx. 1.6 miles long
- Connects Theater District to Tacoma Dome



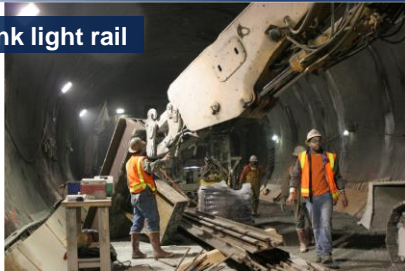
- Opened in 2009
- Serves Westlake Station to SeaTac Airport
- 13 Stops
- Approx. 15 miles long



### Central Link Light Rail

### University Link light rail

- 2016 opening
- Stations at:
  - Capitol Hill and
  - Husky Stadium



### Northgate Link Extension

### South Link light rail Angle Lake (s. 200th)



“ST2”

- 36 miles of new light rail (total 55-mile system)
- Expanded Bus Service
- More Commuter Rail Trips



### Planning and Designing North, South, & East Light Rail Extensions



### Agency ESMS policies

- Environmental Policy - 2004
- Sustainability Initiative - 2007
- Integrated Pest Management Plan - 2009

### What is ESMS?

Environmental and Sustainability Management System

### Sound Transit's Sustainability Framework

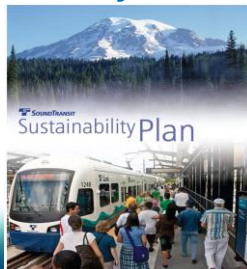
**People**  
Enhanced Mobility  
Livable Communities  
Engaged Community

**Planet**  
Energy & Emissions  
Sustainable Design  
Sustainable Materials  
Water Quality & Ecosystem Protection

**Prosperity**  
Creative Partnerships  
Green Supply Chain  
Total Cost Management

## Sound Transit's Sustainability Plan

- Agency resource use
  - Energy & GHG emissions
  - Water use
  - Waste, recycling, composting
- Best practices
- Environmental compliance
- Staff stakeholder process



### ESMS certifications

National and international recognition

## Water Conservation and Toxic Use Reduction

Reduce indoor and outdoor water use by 1% per year (avg)



Reduce the use of toxics in the environment



## Integrated Pest Management (IPM) Plan

- Soil
- Design
- Plant installation and maintenance
- Pest knowledge
- Tolerance thresholds
- Monitoring and evaluation
- Record keeping



## Landscape Evaluations

Evaluated 25 stations in 2010 and 2011



- Lack of mulch
- Bare soil
- Improper tree and shrub pruning/hedging
- Line trimmer damage on trees
- Dead or declining trees
- Invasive plants and noxious weeds
- Poor drainage - overwatering

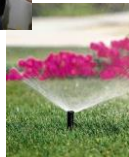


## Biggest Landscape Maintenance Issues

## Water Conservation

Scheduled FREE Irrigation Audits:

- Seattle Public Utilities (Seattle - OMF, Mercer Island)
- Cascade Water Alliance (Overlake Transit Center, Issaquah P&R)



Observations and Recommendations for Sound Transit Mercer Island P&R

John Easley  
2014

### Informal Poll

1. How many feel underpaid?

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### Informal Poll

1. How many feel underpaid?
2. How many feel overworked?
3. How many know they could and would do a better job given more time and resources?
4. In 2011, did any of you work at this site?

### ASSESSMENT REVIEW

- Four areas were assessed.
  1. Full sun turf
  2. Full sun tree and shrub
  3. Tree and shrub in shade
  4. A client selected "problem" area

### ASSESSMENT REVIEW

- Each area inspected included an examination of :
  1. Soil
  2. Plant material
  3. Irrigation hardware and management practices
  4. Landscape management practices that affect irrigation efficiency

## OVERALL SUMMARY

- The landscaping appears neat and groomed.
- Ground covers are well established.
- The soil on site looked to be imported during construction.
- It consisted of a nice, dark sandy loam ranging from 5" to 14" in depth.

## Plant list

- Acer Sp.
- Acer Rubrum
- Rhus Typhina
- Liquidambar Styraciflua
- Cornus Kousa
- Pinus Densiflora
- Pyrus Calleryana
- Chamaecyparis Obtusa
- Viburnum Plicatum Tomentosum
- Vinca Minor
- Euonymus Fortunei

## Landscape Design is the Recipe

- Each landscape has a plant water requirement
- If the "recipe" calls for "two eggs".....
- That's what is called for to make the recipe work as intended
- That's the amount of water that needs to be provided for the landscape to grow as intended

## Reference Evapotranspiration- $E_t_o$

- $E_t_o$  = how much water a cool season turf will use when it is 4 – 6" high and well watered.
- If you are watering:
  - Cool Season turf: 65-75% of  $E_t_o$
  - Trees and shrubs: 60-80% of  $E_t_o$
  - Natives: 30–50% of  $E_t_o$

## Precipitation Rate Averages

- Spray heads 1.5"/hour
- HI-DU Rotary Nozzles 0.4"/hour
- Rotors Heads 0.75"/hour

## Three Options for Reducing Site Water Use

1. Improve System Efficiency
2. Reduce Site Net  $E_t_o$
3. Improve Scheduling

## Focus on Watering Better

- Keeping the water in between the lines
  - Keep water off of hardscapes and in target area
  - Avoid run off, ponding, and deep percolation
  - Timely maintenance

## Better Irrigation Scheduling

- Find a source for local  $E_t_o$   
– [www.iwms.org](http://www.iwms.org)
- Take more time to do a better job of manually changing runtimes on the controller
- Invest in some Sensor Based Technology or central control for your system and scheduling

### Trees

Several trees were flagging and clearly in a stressed condition.



### Trees planted too deep



### Mulch piled up around the root flares



### Trees planted in wire baskets



Damage to root flares



Mower/weed eater damage to trunks



Evidence of possible chemical use



Overwatering



??????



**Trees**

- Recommended getting a tree assessment from a certified arborist to determine hazards, remedies, and survivability of the trees on site.



## Irrigation Hardware



The irrigation system is controlled by a stand-alone Rainbird ESP-MC 12 controller.

- No rain switch
- No remote control
- Master valve

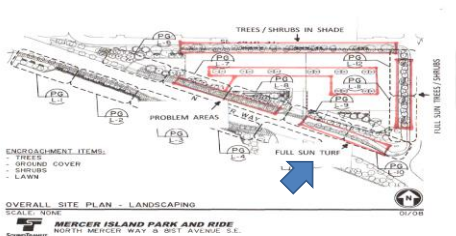
## Irrigation Programming

- Date of assessment was September 14, 2011
  - All zones were programmed for 10 minutes or more, although 1 zone had 7 minutes.
  - Everyday!

## Irrigation Heads

- Rainbird 1800 heads
- Rainbird matched precipitation rate and variable angle nozzles
- Rainbird bubbler nozzles

## FULL SUN TURF



### FULL SUN TURF

The turf is parking strip approximately 172' X 12' tapering on one end. The irrigation system used Rainbird 1800 spray heads only on the street-side curb spraying toward the sidewalk. This causes dry spots behind trees, traffic signs and other obstructions.



**Maintenance?**

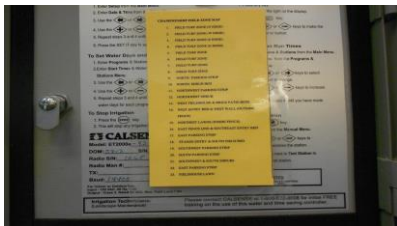
There was one bad nozzle and a lateral break causing wash-out and water waste.



**Timely maintenance needed**



**Zone List**

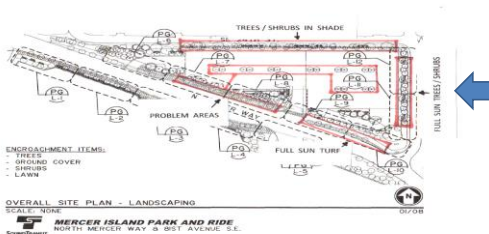


**Recommendations**

- Use 4" heads and cut sod away
- Adjust flow control handle at the valve
- Change nozzles on tapered end of turf to prevent overspray
- If hydraulically possible, install a lateral and heads on the sidewalk-side of the area and change all spray nozzles in the zone to high DU rotary nozzles
- Layout heads to minimize spraying the tree trunks



**FULL SUN TREES & SHRUBS**



**FULL SUN TREES AND SHRUBS**

The bed area is a mixed planting of trees, shrubs and ground covers in a full sun exposure. Area had about 1" of mulch covering the bare areas of the bed while the ground covers are still establishing. The irrigation covered the area well with Rainbird spray heads. One nozzle was broken and in need of replacement.



**FULL SUN TREES AND SHRUBS RECOMMENDATIONS**

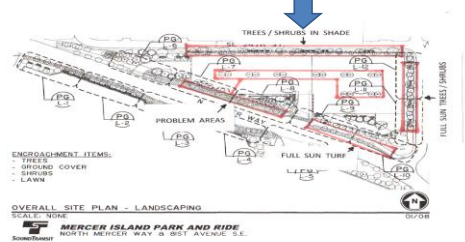
Maintain tree wells and mulch rings around trees and woody shrubs even in ground covers to reduce competition for nutrients and water.

Decrease water usage by developing a proper ET-based watering schedule that considers climatic conditions, plant material, and soil.

Consider replacing spray nozzles with High DU rotary nozzles.



**TREES & SHRUBS IN SHADE**



**TREES & SHRUBS IN SHADE**

Area consisted of a mixed planting of trees, shrubs, vines, and ground covers.

It's located on the north side of the garage structure and only receives direct sun a few hours a day.

The soil is a sandy loam and wet almost to the point of saturation.



**TREES & SHRUBS IN SHADE RECOMMENDATIONS**

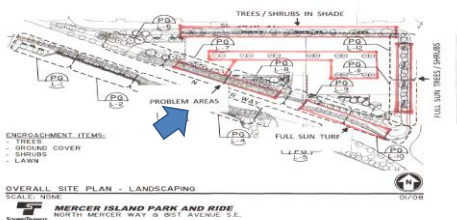
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**CLIENT SELECTED PROBLEM AREA**



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The problem areas examined were elevated planters and tree pits in the sidewalk.

**ELEVATED PLANTERS**

Several trees in the planters were visibly stressed and there were several stumps where the trees had failed and been removed.  
 The soil in the planters and pits was a sandy loam and wet almost to the point of saturation.  
 The area around the bottoms of the elevated planters had accumulations of mud, water, and moss, evidence of either excessive amounts of drainage or overspray outside the target area.



**Maintenance needed**

**End strip nozzles**



**Side strip nozzles**



**Tree pits in the sidewalk**

**MPR NOZZLES**



**BUBBLERS**



**Recommendations**

- Repair stuck heads in elevated planters and bubblers in tree pits
- Decrease water usage by developing a proper ET-based watering schedule that considers climatic conditions, plant material, soil types, and irrigation system efficiency
- Change either the bubblers to spray nozzles or spray nozzles to bubblers to achieve matched precipitation or use 2 valves, one for bubblers and one for spray nozzles
- Consider using drip irrigation in the elevated planters for additional water savings



**2 Major Factors for Savings**

**Maintenance**

1. Zone list in the controller
2. Biweekly inspection using the test program
3. Fix the broken equipment ASAP

**Scheduling**

1. Find a source for local ET data
2. LA submit a schedule for the design (owner require it in the contract)
3. Document runtimes on Zone list

**Mercer Island Irrigation Audit - Follow Up**

- Create a detailed Scope of Work
- Budget for upgrades
- Did work actually occur?
- Installation this year (.....persistence is the key)



## Irrigation Audit Findings and Water Strategy

### Major Findings:

- Watering areas more than necessary
- Broken lines



### General Recommendations:

- Develop evapotranspiration (ET) based watering schedule to match plant requirements (**adjust controller!**)
- Replacing nozzles and spray heads; add flow sensors and rain gauge
- Add mulch or compost to conserve water
- Use drought tolerant plants
- Meter and track water usage separately

## Water Conservation

The Central Link Operations & Maintenance Facility (OMF) used the most water of any single facility and had the highest percentage of water costs.

| Facility   | Water Usage (CCF) | Water Cost (\$) |
|--|-------------------|-----------------|
| Central Link Operations and Maintenance Facility | 4,615             | \$71,139        |
| Overlake Transit Center                          | 2,147             | \$14,430        |
| Summer Station                                   | 1,599             | \$11,587        |
| Union Station                                    | 1,518             | \$23,112        |
| Federal Way Transit Center                       | 1,317             | \$5,773         |
| East Station and Garage                          | 1,206             | \$13,785        |
| Mercer Island Park-and-Ride Lot                  | 1,060             | \$4,202         |
| South Hill Park-and-Ride Lot                     | 1,042             | \$3,753         |
| Auburn Station and Garage                        | 1,030             | \$6,302         |
| CLR Wayside - 15426 35th Ave S                   | 1,015             | \$6,555         |
| All other 44 facilities combined*                | 7,576             | \$63,778        |
| <b>Total</b>                                     | <b>24,125</b>     | <b>225,425</b>  |

Top 10 Facilities by Water Cost in 2011

## Water Conservation – C-Link OMF Deduct Meter

Before the deduct meter was installed at the C-Link OMF in 2012, wastewater sewer fees were the largest contributor to water expenditures at the facility, historically costing an average of \$2,616 a month.

In the first two invoice periods after the deduct meter was installed, sewer costs decreased an average of \$1,733 per month.



| Deduct Meter Costs and Savings                      |                     |
|---|---------------------|
| Cost for equipment, installation and utility set-up | \$ (2,600.00)       |
| Saved in first four-month bill                      | \$ 7,690.00         |
| Saved in second four-month bill                     | \$ 9,960.00         |
| <b>Total Saved (First Four Months):</b>             | <b>\$ 15,050.00</b> |

## Overlake Transit Center

- Decommission irrigation in established plantings
- Decreased Water usage by 17%
- Saving \$2,500 in 4 months

## Recommendations-Water Reduction Strategy

|  | C-Link OMF           | Isaquah TC | Minor and Park | Overlake TC |
|--|----------------------|------------|----------------|-------------|
| Install, repair, or upgrade irrigation system components including sensors, control systems, sprinkler heads, and valves   | X                    | X          | X              | X           |
| Tailor watering schedules to consider weather, plant types and establishment, soil types, and irrigation system efficiency | X                    | X          | X              | X           |
| Apply soil amendments such as compost or mulch to conserve water and improve soil health                                   | X                    |            | X              | X           |
| Use appropriate plantings for each bed, choosing native or other drought-tolerant plants when possible                     | X                    | X          |                | X           |
| Increase management oversight of existing landscape installation and maintenance contracts                                 |                      | X          | X              |             |
| <b>Estimated Annual Water Savings (CCF per year)</b>   | <b>Not Available</b> | <b>51</b>  | <b>210-530</b> | <b>354</b>  |
| <b>Overlake figure represents actual savings in 2012</b>   |                      |            |                |             |

## Mulch

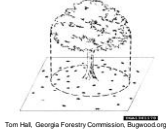
- Maintain soil moisture
- Suppress weeds
- Help prevent compaction
- Help prevent erosion
- Provide nutrients to the soil
- Prevent damage from mowing equipment



Photo by Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida

## Where and How to Mulch

- Apply mulch to entire planting bed where possible
- Apply mulch to outer drip line of the tree canopy
- Apply a 3-4" layer of mulch
- Pull mulch away from trunk



## Landscape Training program - 2013

- Make observations
- Ask lots of questions
- Created assessment field "Cheat Sheets"

| Trees, Shrubs, and Pruning:<br>The Good and the Bad |      |  |     |
|---|------|--|-----|
|   | Good |  | Bad |
| Tree pruning  |      |  |     |
| Mulching  |      |  |     |

## Howard Stenn Irrigation Training

- Cascade Water Alliance Provided Consultant Assistance to Sound Transit
- Trained Facilities Staff
- In-house Slide presentation
- Site Evaluation and practice



## Turf Assessment

Check For:

|   |                   |  |                      |  |
|---|-------------------|--|----------------------|--|
|   |                   |  |                      |  |
| Yellowing   | Soggy Areas       | Dead Areas   | Weeds                | Dead Patches   |
| <b>Abiotic</b> <ul style="list-style-type: none"> <li>• Soil compaction</li> <li>• Poor grading</li> <li>• Lack of nutrients</li> <li>• Lack of water/too much water</li> </ul> |                   | <b>Biotic</b> <ul style="list-style-type: none"> <li>• Plant diseases</li> <li>• Insects</li> <li>• Animals</li> </ul> |                      | <b>Human</b> <ul style="list-style-type: none"> <li>• Over fertilizing</li> <li>• Misapplication of pesticides</li> <li>• Scalping – mowing too short</li> <li>• Over-irrigation/under-irrigation</li> </ul> |
| <b>Best Maintenance Practices</b>   |                   |  |                      |  |
|   |                   |  |                      |  |
| Build healthy soil  | Mow height 2 – 3" | Mulch mow  | Irrigate 1" per week | Aerate and thatch  |
|   |                   |  |                      |  |
| Overseed & compost  |                   |  |                      |  |

- |                                |                       |
|--------------------------------|-----------------------|
| Drought Tolerant Plant Species | Limit the use of Turf |
| Rain Sensors                   | Water Budget          |
| Flow control valves            | Maintenance Plan      |
| Deduct meters                  | Rainwater Harvesting  |



## Updated Agency - Design Criteria Manual

## Lessons Learned

- Landscapes require constant attention
- Simple Fixes – big impact
- Water use can be reduced – if managed
- Educated staff and Consultants
- Budgeting / Planning for upgrades



## ST Sustainable Landscape Program

- Integrated Pest Management (IPM) Plan
- Landscape Best Management Practices Manual
- Landscape Site Assessments
- Irrigation Site Assessments
- Training Program
- Revise Contractor Scope of Work
- Updated Design Criteria Manual
  - Water Budget
  - Maintenance Plans
- Site Checklist



Questions?

## Thank you and Happy Trails!

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