



Reduce Vegetation CI in Toledo Blade

Barry Grubb

Distribution

Green Belt

Date Last Updated: 11/12/2012



Reduce Vegetation CI in Toledo Blade

Project Description

Problem Statement: From Jan 2009 to Feb 2012 ,46 Feeders with high customer density laterals averaged 42 CI/N for vegetation outages in Toledo Blade

Project Goals: Reduce vegetation monthly average Lateral CI/N from 42 CI/N to 28 CI/N for these 46 feeders.

Months required to test significance: 3 Months

Team

Project Role	Name	Area of Expertise	Hrs/Wk
Lead	Barry Grubb	VM Lead	6
Mentor	Eli Viamontes	Black Belt	2
Champion	Tom Gwaltney	Distribution	1
Core Team Members	Dennis Duwe	Distribution	2
	Robert M Bergin	Arborist	3
	Jim Jordon	Reliability data	1

Business Impact

Financial Benefit	Hard, Soft	Yearly \$ savings	# Yrs of benefits
Saving of \$35 per CI avoided with reduction of 17 CI per N and TB VEG Lat N per month.	Hard	\$,7,400	3

Intangible Benefits

- Improve customer satisfaction with less frequent outages. Reduce risk of injury and fire from deferred tree conditions near primary wires.

Risks

- Increased emphasis on reducing lateral CI could increase feeder CI.

Timeline

Phase	Planned	Actual
Training (classes)	10/3/2011	10/3/2011
Test(s)	12/9/2011	12/9/2011
Launch	9/7/2011	9/7/2011
Define	10/21/2011	10/21/2011
Measure	12/16/2011	12/15/2011
Analyze	2/24/2012	4/4/2012
Improve	5/4/2012	11/11/2012
Control	6/15/2012	11/11/2012



Project Charter Supporting Detail

(continuously updated to reflect current knowledge)

Certification Desired: Green Belt

Strategic Fit: Execute Reliability Work Plan

Measurable Project Goals

Voice of the Customer				Performance		
Who is the customer?	What customer need is not adequately being met (Big Y, CTQ)?	How will performance be measured (Project Y)?	Customer Specification	Current (Baseline)	Entitlement (Best Actual)	P8project Goal
Internal	Veg CI per Lateral N in TB	Veg Lat CI/N	0	42	4	28

Risk Evaluation/Mitigation

Customer need that may be negatively impacted by your project	Risk Level (H,M,L)	Consequential Metric (if Risk = M, H)
Shifting VM resources to lateral work may increase Veg feeder CI	M	Increase in Veg Feeder CI

Benchmarking Results:

No benchmarking for this project



What is the scope of your project?

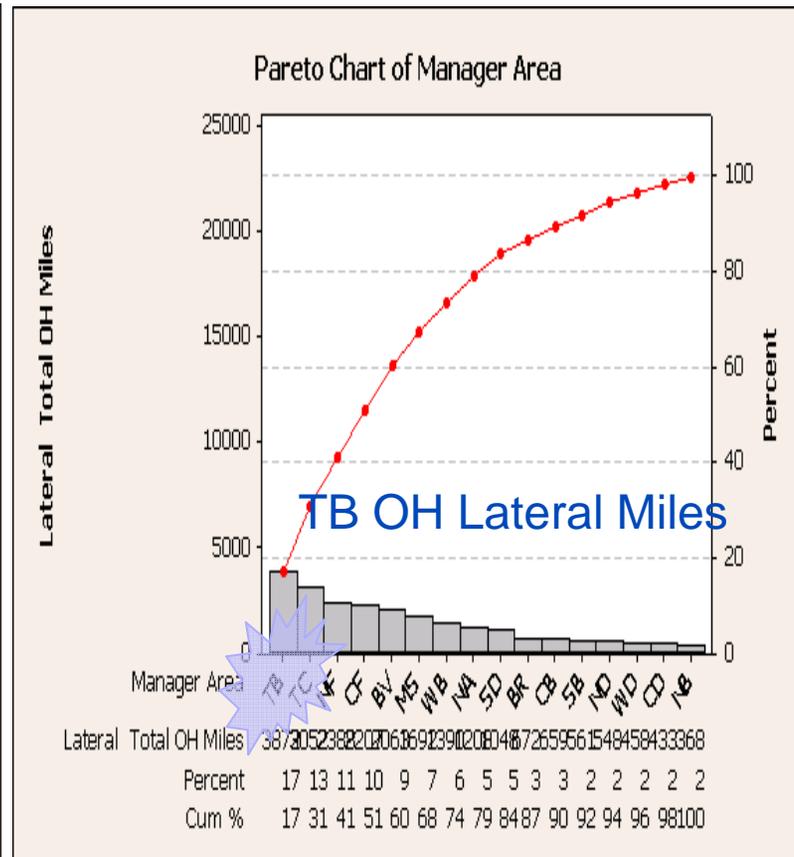
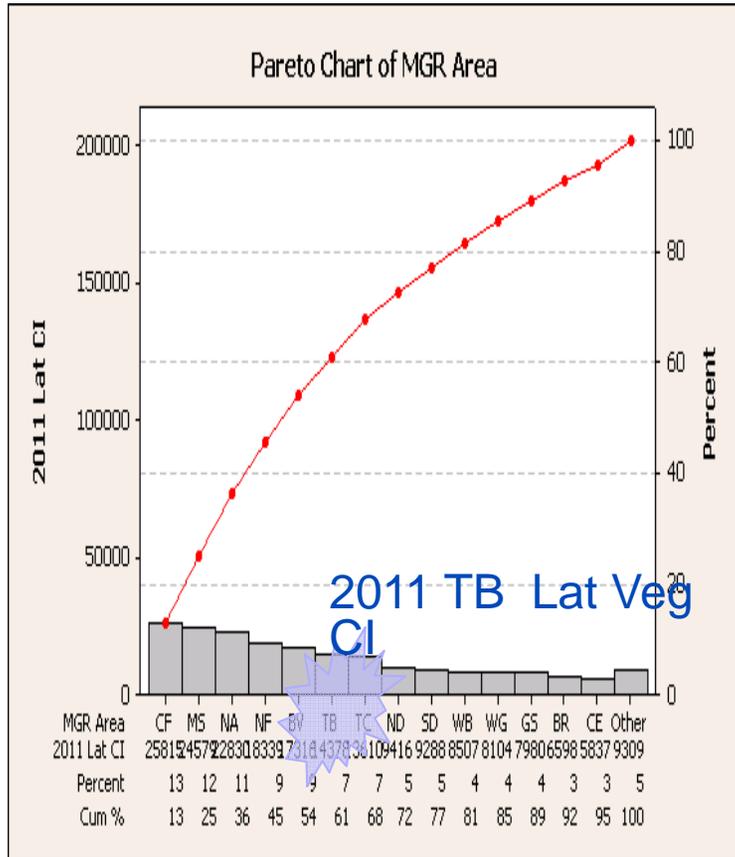
Definitions and Acronyms

- **Vegetation Management (VM)** – Noun, referring to the distribution group that maintains facilities clear of vegetation to ensure safe and reliable service.
- **Vegetation (Veg)** – Noun, referring to the trees, palms, vines that grow, blow, or fall into distribution facilities.
- **Toledo Blade (TB)** - A Distribution Operations Management Area in the West Region.
- **Customers Interrupted (CI)** – Distribution accounts that lose electrical service for more than 1 minute.
- **Feeder (Fdr)** – Un-fused distribution primary line from substation.
- **Lateral (Lat)** – Fused distribution primary line from Feeder.
- **Restoration Specialist (RS)** – First responder to investigate distribution trouble tickets.
- **Service Level Agreement (SLA)** – Target complete date.
- **Overhead = (OH)** – Above ground distribution power lines.
- **Underground = (UG)** – Below ground distribution power lines
- **VM Deployment Plan** – Annual Planned Maintenance work plan consisting of three types of work units: Feeder Backbones, Lateral Circuits, and 1st stage fused Laterals



Why address TB VEG Lateral CI/ N ?

2011 Veg CI and OH Miles by Operation Manager Area



TB has 7% of Vegetation lateral Veg CI and 17 % of total OH lateral Miles



What is the scope of your project?

Preventative Maintenance

2012 VM Budget by Activity

Preventive Maintenance

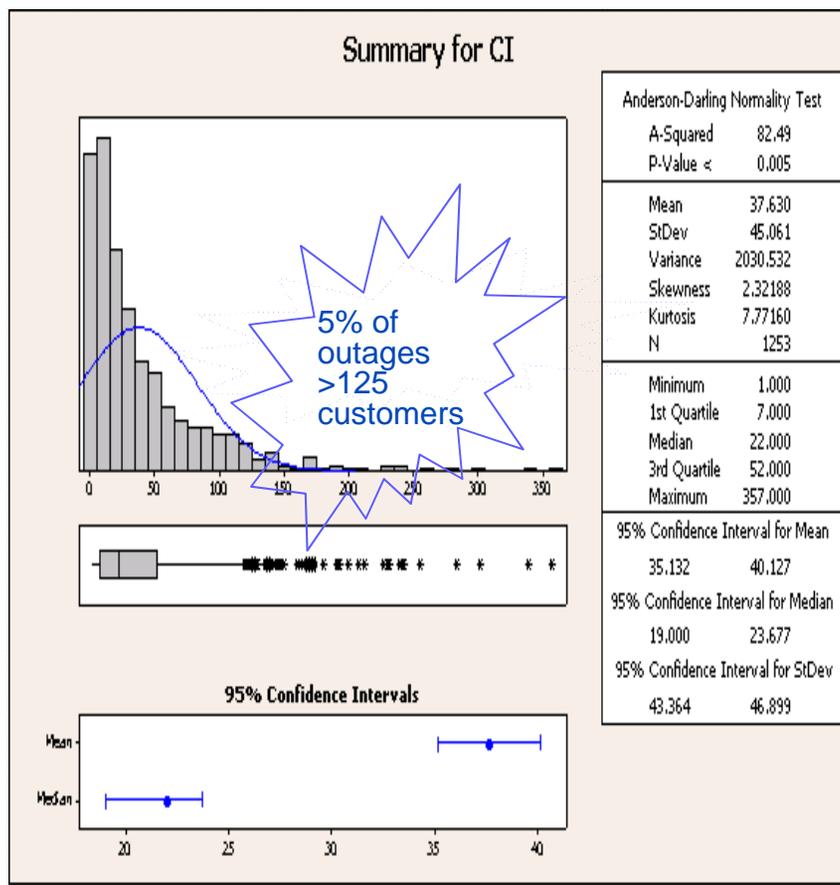


- Distribution Feeder lines are on an average 3 year cycle with Mid-cycle patrols to identify and trim palms and fast growing tree between cycles.
- Distribution Lateral lines are on an average 6 year cycle with selection criteria:
 - Weighted Reliability performance
 - More than 3 Years since Last Trim Date
- 5% worst performing Lateral device by Veg CI
- Reliability programs
 - Critical Palm Tree removal program
 - Palm Management program
 - Danger Tree Removal
 - Strategic widening of rights of way ROW

Prevent vegetation lateral outages on high customer density laterals.

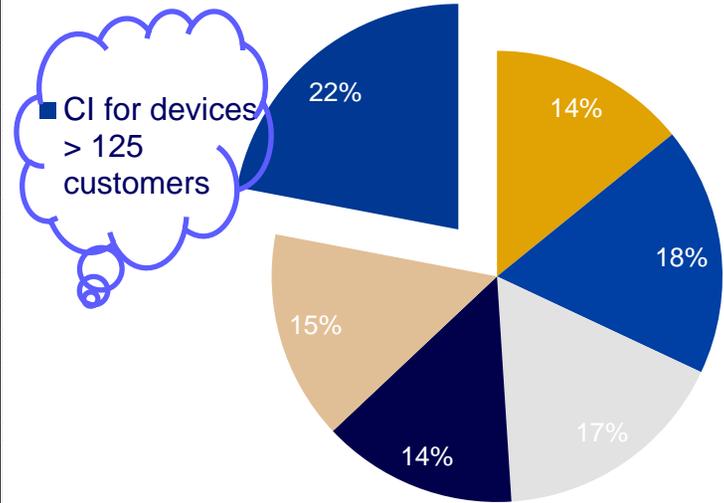


Why address TB VEG CI/N? High customer count laterals outages skew the distribution of CI/ N for TB Veg Lat CI/N



TB Vegetation CI by customers served on device

22% of TB Lateral CI was on Lateral devices greater than 125 Customers

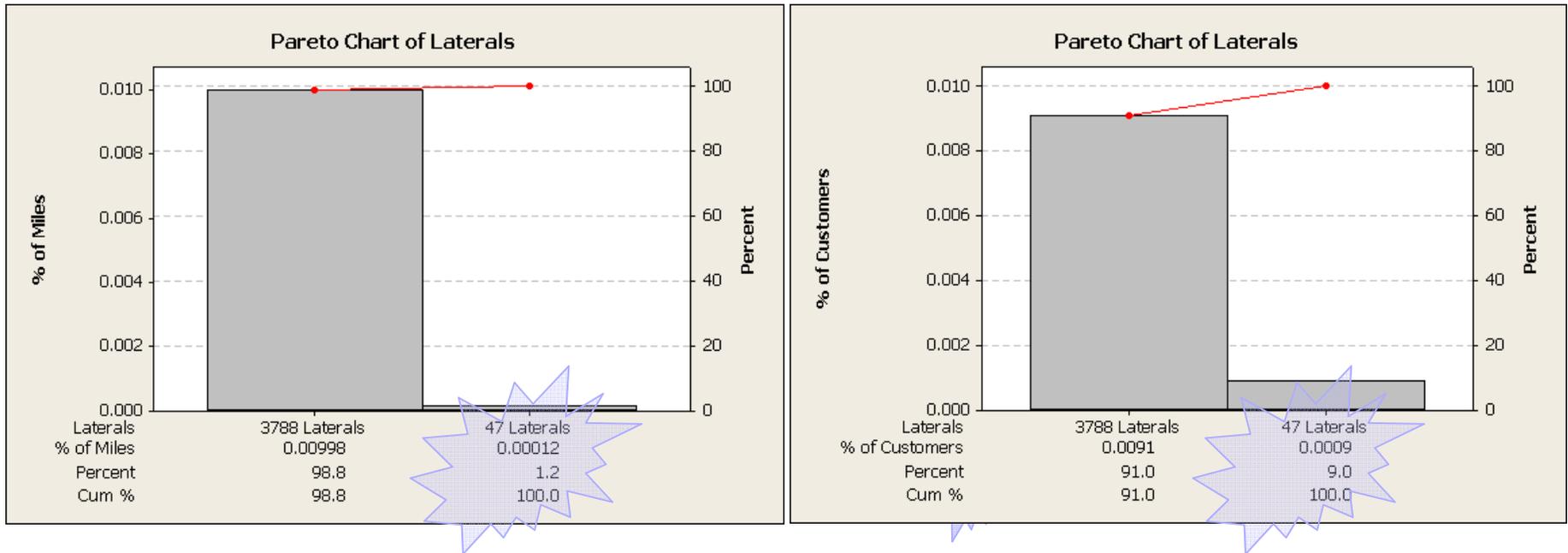


22% of VEG Lat CI is caused by 5% of the outages on lateral devices greater than 125 customers.



Why address TB VEG Lateral CI/ N ?

High Customer Density devices in Toledo Blade



47 High Customer Density laterals 1.2 % of the miles and 9% of the customers on 47 Feeder circuits.



Reduce Vegetation CI in Toledo Blade

Project scope will identify at risk TB laterals to deploy countermeasures to reduce frequency.

Suppliers	Inputs	Process	Outputs	Customers
TB external customer	Reports tree outage		Trouble Ticket	Restoration Specialist (RS)
RS	Restores or defines scope	Restore	Complete or referred ticket	Tree crew
Tree crew	Executes tree work	Tree related	Completed work	RS or Line Crew
RS or Line Crew	Completes line work or refuse device	outage in TB	Restored ticket	TB External Customer
	Vegetation outage in TB	RS defines Tree work to restore	Tree crew completes required work	RS or Line crew restores service

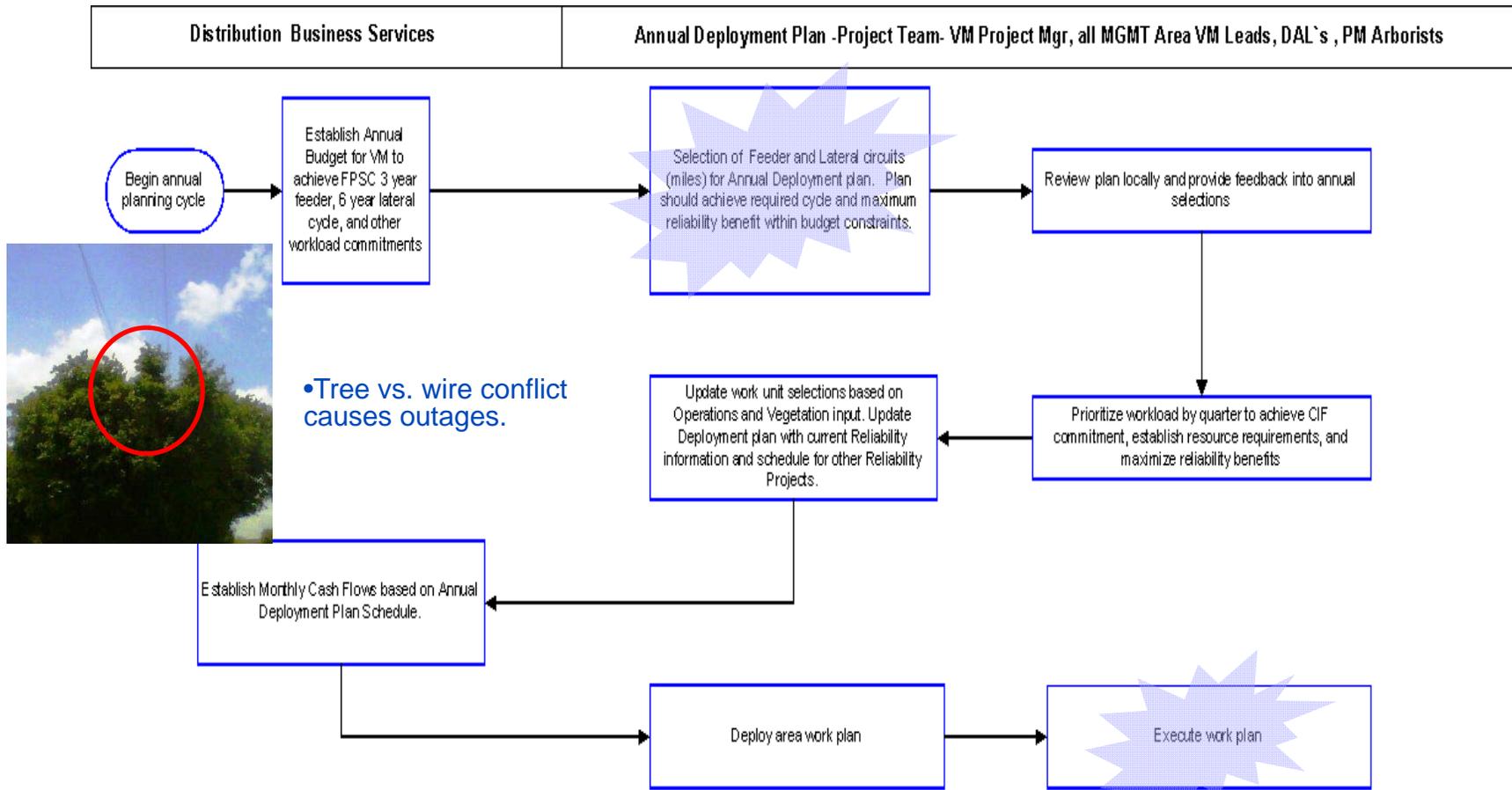


Prevention of tree related lateral outages will reduce total CI.



What are the steps in the process?

Preventing tree related outages is one objective of VM Planned Maintenance process.



Selection and execution of VM Planned Maintenance work units are primary steps in the process.



How was the data collected?

Measurement System Description

•Metric = TB VEG LAT CI/N

Primary Metric Operational Definition: Monthly data warehouse reports for lateral interruptions with vegetation cause codes in Toledo Blade will be generated to extract vegetation lateral N and lateral CI to calculate TB VEG LAT CI/N.

Measurement Systems: TCMS & Data Warehouse

Data Validation

- ⊕ In real time, Restoration Specialist and Dispatchers validate the data once RS as perform initial assessment of the trouble location and customers out. Restoration Lead also monitors TCMS during outages to help validate trouble ticket.
- ⊕ Interruption data in TCMS is accurate. Trouble Tickets are validated on a daily basis by Control Center Lead and Dispatchers. At the local management areas, Delivery Assurance Leads also review ticket information to ensure accuracy of interruption codes and interruption times.
- ⊕ Trouble Ticket information can be changed up to 60 days after interruption to ensure validity of the data.

Data Accuracy

- ⊕ TCMS records outage data from the first customer call to the last relating to the device experiencing the outage. All comments, steps and times are recorded by the system.
- ⊕ Information will be transferred to Data Warehouse which is reliable and repeatable on all trouble tickets. Historical data cannot be altered and any changes will need to be made on TCMS up to the 60 day validation mark.

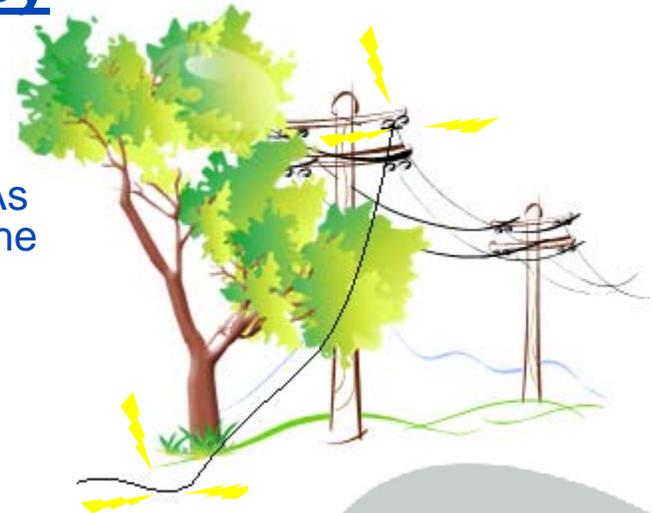


TCMS data is based on customer calls and verified by field personnel. Data is reviewed at 3 levels to ensure accuracy and validation.

Is the data accurate, repeatable, and relevant?

Data accuracy

- The interruption data in TCMS is very accurate. As customers are experiencing an outage, they call the FPL phone board to report the outage. TCMS automatically assigns the interruption level (type) based on the amount of customers reporting an outage and their device association. The interruption type is also confirmed by the trouble-man during restoration efforts and reviewed for accuracy by the dispatcher-lead and area supervisors.
- Upon completion, the system automatically sends the ticket to the data warehouse (Report Net).
- The interruption data was retrieved from Report Net using the Cause Code Research application.

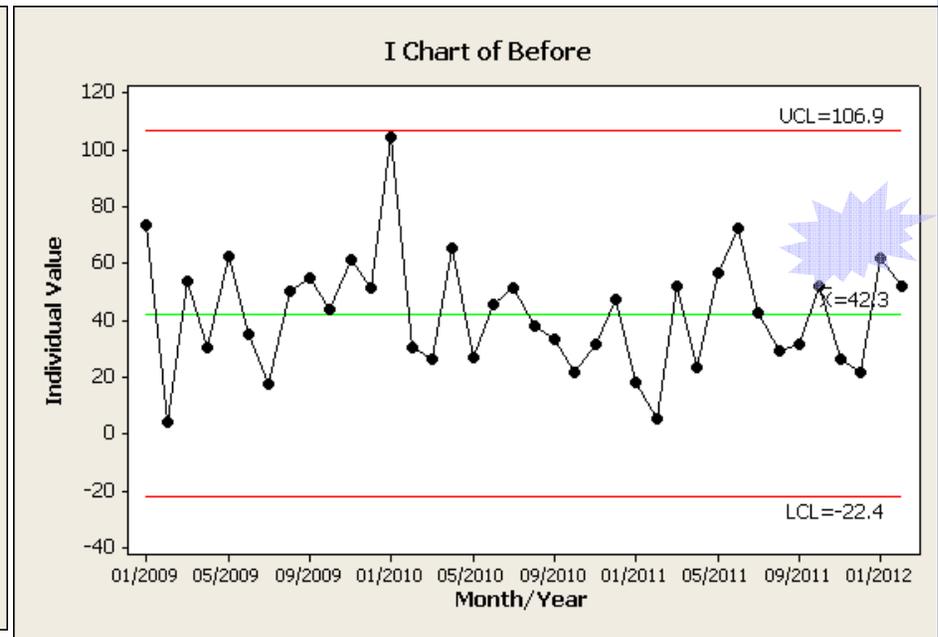
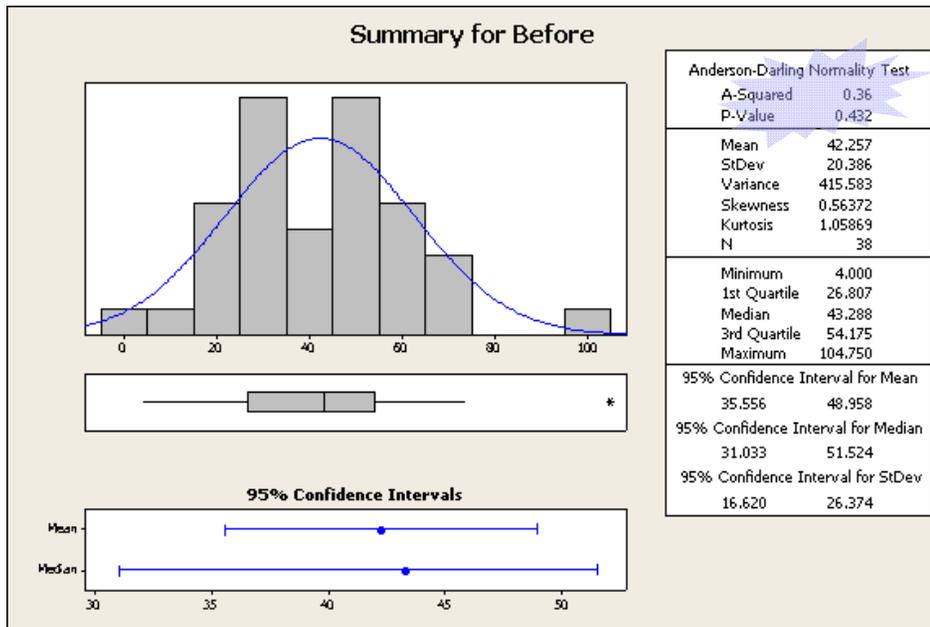


The interruption data is accurate as it is based on customer calls and system acknowledgement. It is verified by the trouble-man during restoration efforts and reviewed.



Is the process stable and in control?

TB VEG Lat CI/N is in Control.

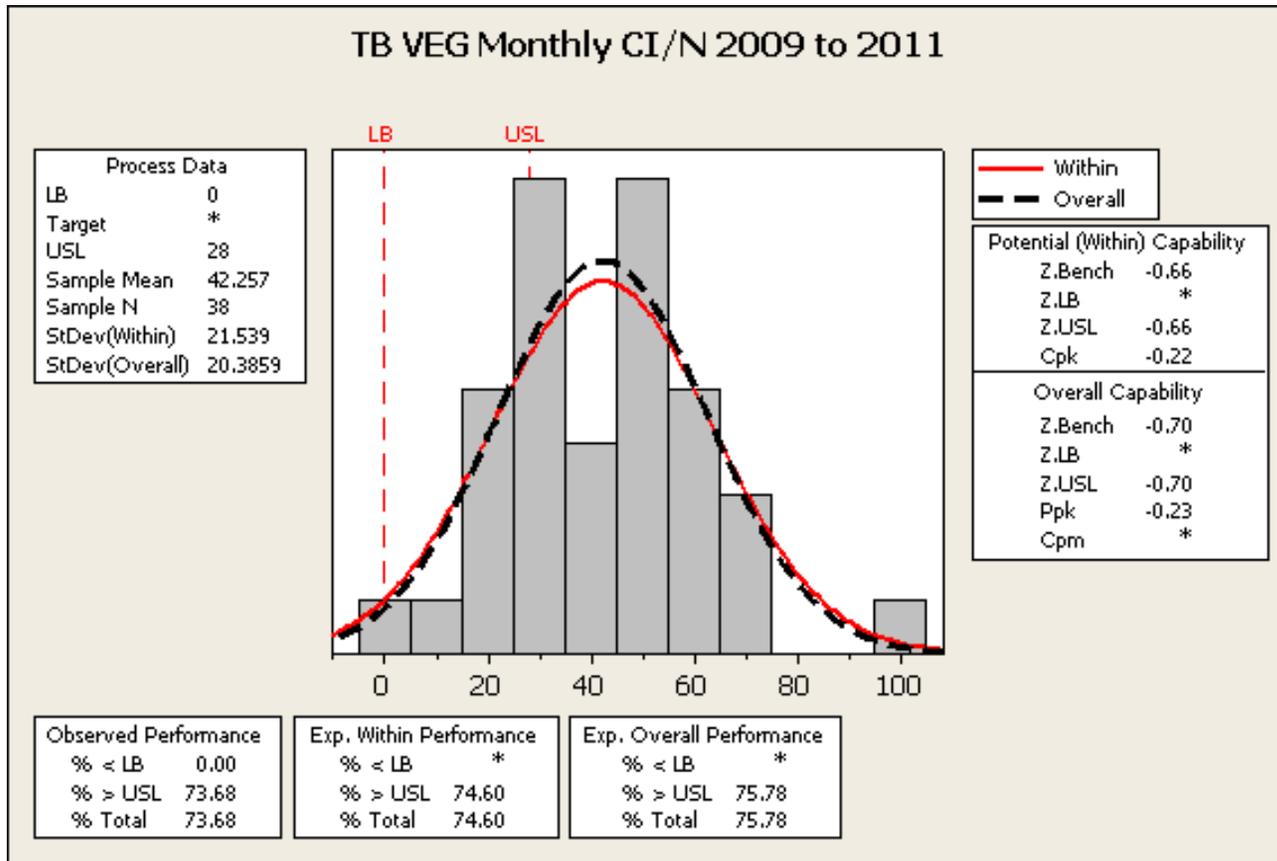


P value is normal and the process is stable and in control. Mean CI/N for Veg CI/N for 47 circuits is 42.



The process is not capable of preventing outlier CI/N

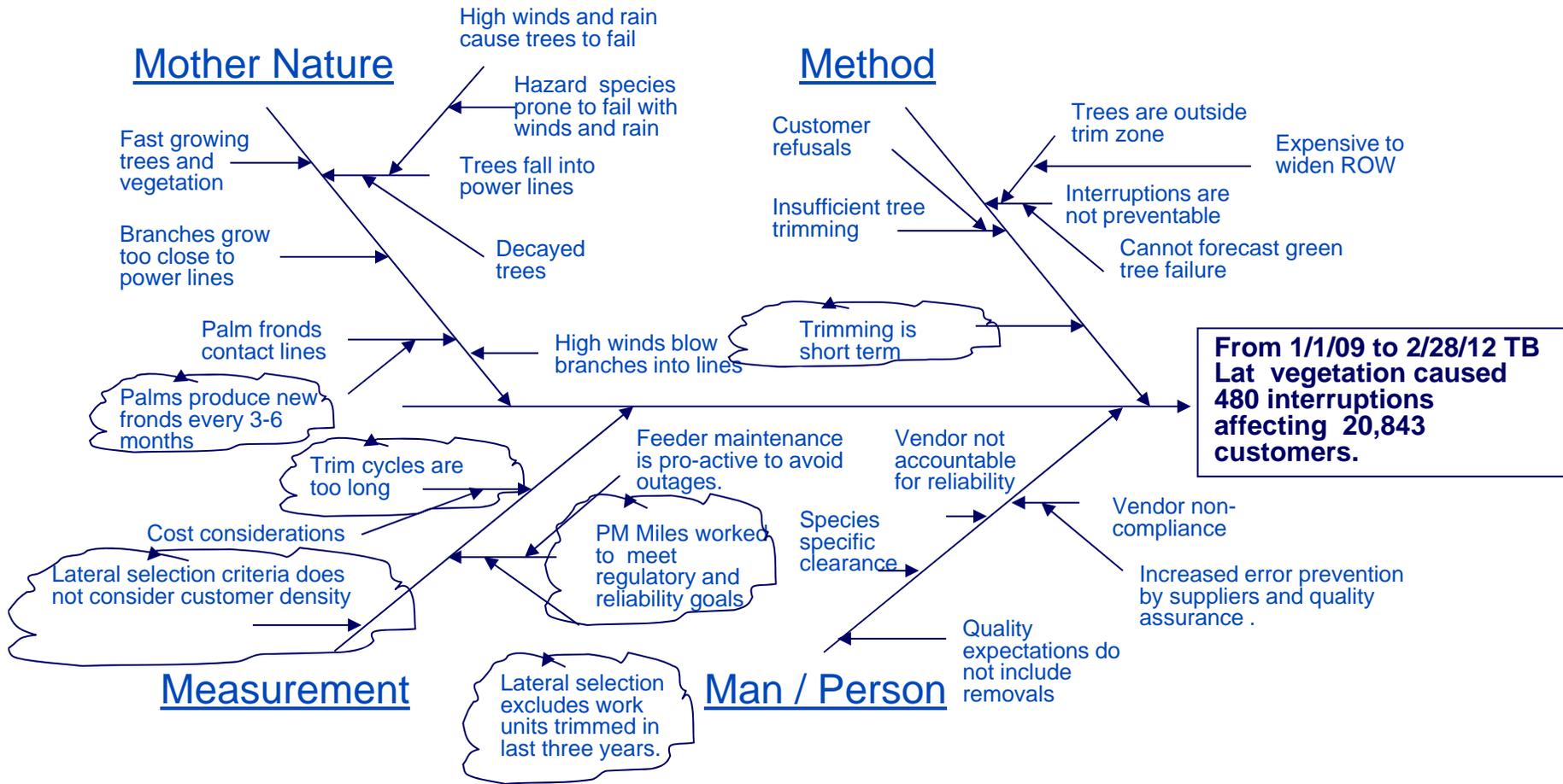
Capability Analysis for TB VEG Lat CI/N



The process is 27 % capable to achieve a maximum of 28 Veg CI/ N monthly. The target CI/N differs significantly from the mean.



REFINE SCOPE: KEY PROCESS INPUT VARIABLES (KPIV'S)



Criteria for selection of work units, frequency of trimming and lateral miles for planned maintenance are key process inputs for reducing outlier TB Veg CI/ N.



What inputs (x's) are likely to have the strongest impact on your primary metric (Y)?

		1	2	3	4	5	
		Maximize reliability benefit per mile trimmed	Achieve FPSC Miles commitment	Prevent 1st Veg outage	Prevent Multiple Veg outages	Reduce MAIFI	Total
Process Step	Process Input						
Lateral selection process	Customer Density per OH Mile	9	9	9	9	4	380
	Last trim date	9	9	9	4	4	330
	VM Lateral miles allocated for planned maintenance	9	4	4	9	4	280
	Historical reliability performance	9	4	1	9	4	250
	FPSC cycle requirements	4	9	1	1	1	155
	Unit cost per mile contract	9	4	4	4	4	230
Execute work	Trim Standards	9	4	4	4	4	230
	Tree removal criteria	9	1	1	4	4	170
	Quality assurance	9	1	4	4	1	185

1st
2nd
3rd

Looking at high customer density laterals, Last Trim Date and Lateral Miles allocation will be analyzed in the FMEA.



What causes are driving critical input failures to the problem process ?

The selection and allocation of resources for outlier lateral work units for planned maintenance.

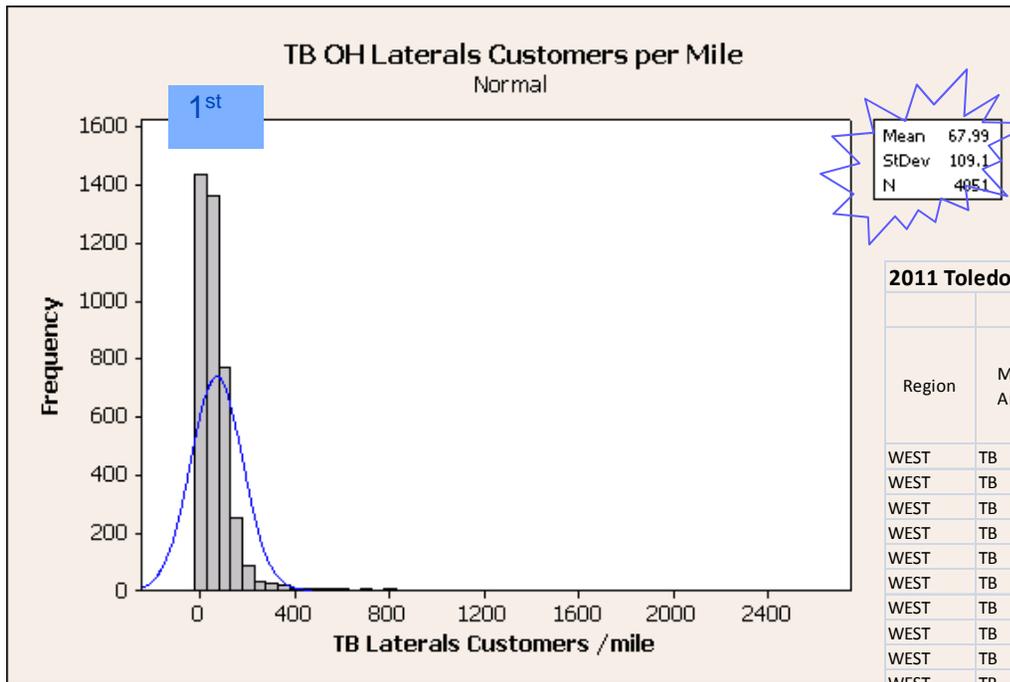
Process Function (Step)	Potential Failure Modes (process defects)	Potential Failure Effects (KPOVs)	S E V	Potential Causes of Failure (KPIVs)	O C C	Current Process Controls	D E T	R P N
Selection of LLN`s to reduce outlier Veg CI	Fail to maximize Veg TB CI reduction	Customer dissatisfied for failure to prevent outage	7	Missed opportunity to maximize Veg CI reduction	4	No customer density data used in lateral selection	10	280 1 st
Schedule planned maintenance before trees contact powerlines	Fail to prevent tree related outages	Customer dissatisfied for failure to prevent outage	7	Potential for tree related outage	4	Only Laterals devices with last trim date > 3 years selected.	4	168 2 nd
Allocate 5 % of Lateral budget to lateral reliability outlier devices	Fail to maximize Veg TB CI reduction	Customer dissatisfied for failure to prevent outage	7	Missed opportunity to maximize Veg CI reduction	4	Corrective Maintenance processes	3	84 3 rd

All lateral devices currently have the same selection criteria and planned maintenance work process.



What causes are driving critical input failures to the problem process ?

Customer density for 2011 TB lateral devices trimmed was lower than the TB mean customer density for 1st stage lateral devices.



Average customer density for laterals trimmed in 2011 was below the TB mean for customers per mile.

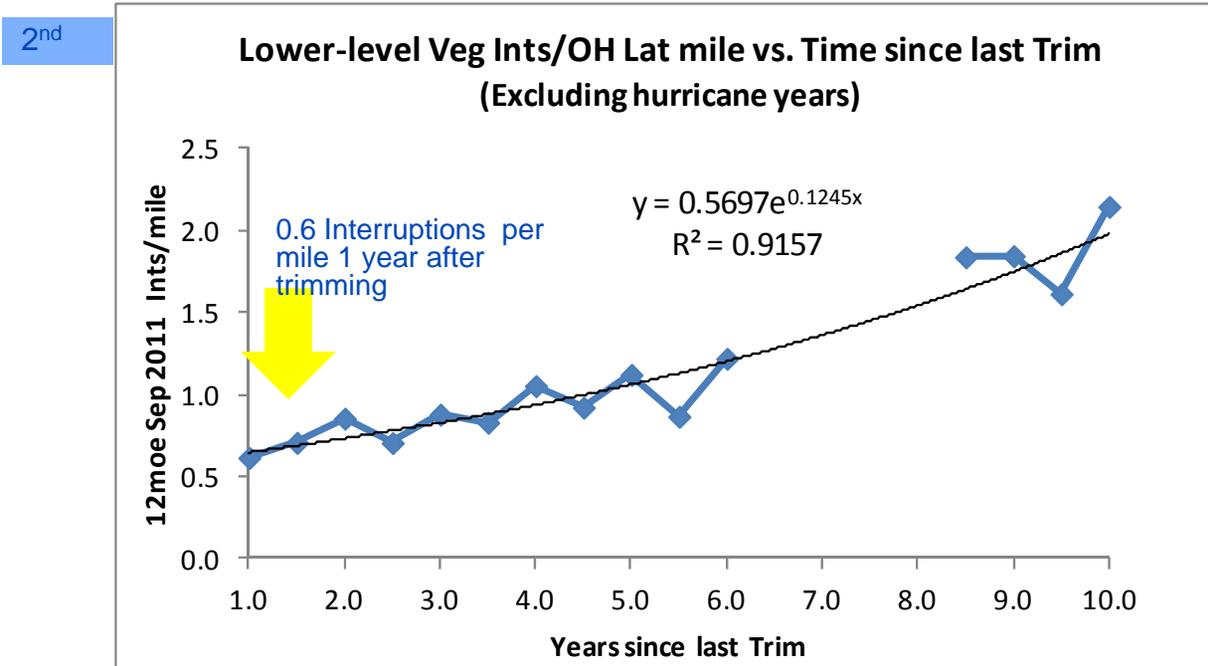
2011 Toledo Blade Planned Maintenance Outlier Lateral Devices								Total Miles	49.97
Region	MGR Area	2011 WR #	Substation	Feeder	Job Code	Original Map Miles	Customer Count	Customers per Mile	
WEST	TB	4097011	Harbor	503766	VMPMLT	0.98	99	101	
WEST	TB	4097014	Harbor	503762	VMPMLT	2.76	300	109	
WEST	TB	4097016	Harbor	503763	VMPMLT	1.98	136	69	
WEST	TB	4097019	Arcadia	501435	VMPMLT	1.79	137	77	
WEST	TB	4097024	Harbor	503766	VMPMLT	1.14	102	89	
WEST	TB	4097027	Harbor	503763	VMPMLT	1.33	67	50	
WEST	TB	4169647	Panacea	508861	VMPMLT	0.7	12	17	
WEST	TB	4169648	Panacea	508861	VMPMLT	5.76	34	6	
WEST	TB	4169649	Panacea	508861	VMPMLT	8.3	170	20	
WEST	TB	4181010	Notre Dame	506861	VMPMLT	6.96	403	58	
WEST	TB	4181016	Rotonda	505662	VMPMLT	0.41	260	634	
WEST	TB	4181021	Murdock	502064	VMPMLT	2.04	136	67	
WEST	TB	4181038	Rotonda	505661	VMPMLT	4.65	205	44	
WEST	TB	4181056	Carlstrom	505962	VMPMLT	0.54	56	104	
WEST	TB	4181064	Franklin	506465	VMPMLT	1.77	96	54	

Customer density for laterals was not a criteria for selection of work units in 2011.



What causes are driving critical input failures to the problem process ?

Potential for tree outages exists 1 year after Planned Maintenance due to Palms and off right of way tree failure.



Excluding high customer density lateral devices from Planned Maintenance for three years does not address at risk tree conditions and potential lateral CI.



What process changes will allow you to reach your project goal by addressing root-causes?

Lateral devices > 2 sigma from mean customers per mile will be patrolled to prevent tree related outages.

Process Function (Step)	Potential Failure Modes (process defects)	Potential Failure Effects (KPOVs)	Recommend Actions	Responsible Person & Target Date	Taken Actions	S E V	O C C	D E T	R P N
Selection of Lat devices to reduce outlier Veg CI	Fail to maximize Veg TB CI	Customer dissatisfied for failure to prevent outage	1 st Change Outlier lateral device selection process to address Lat devices with highest customers per overhead mile	Barry Grubb	Selected and issued for Planned Maint	7	3	6	126
Schedule planned maintenance before trees contact powerlines	Fail to prevent tree related outages	Customer dissatisfied for failure to prevent outage	2 nd Patrol high customer count lateral devices and correct imminent tree conditions	Barry Grubb	Complete patrols for LLN greater than 2 sigma from mean customers per mile	7	4	2	56

Pro-active patrol and vegetation prescription for lateral devices greater than 2 sigma from mean customers per OH mile.



PRIORITIZED COUNTERMEASURES

Patrol and clear imminent conditions on high customer density lateral devices.

1st

2nd

TB High Customer Density Laterals Proactively patrolled and cleared by Feb 28th 2012

Substation:	Feeder:	LLN Code:	OH Lat Miles:	Customer Count:	Cust/ Mile	# of Removals:	CM, PM or Do Not Issue:
			62.03	17922	289		
ALVA	504761	5-7523-6711-0-0	1.46	268	184	PALMS (3)	PM
ARCADIA	501433	5-5959-7304-0-6	0.71	148	208	BAMBOO (1)	PM
CARLSTROM	505962	5-6159-0105-0-2	0.54	556	1030	0	Do Not issue
CLEVELAND	504431	5-5241-6798-0-1	1.03	175	170	2	Do Not issue
CLEVELAND	504432	5-5041-4203-0-4	1.07	187	175	0	PM
COCOPLUM	503261	5-3347-4997-0-1	0.05	192	3840	0	Do Not issue
COCOPLUM	503261	5-3247-8121-0-9	0.98	560	571	0	Do Not issue
71 laterals patrolled: 28- No work, 25 hot spot trim, 18 planned maintenance							

Outlier Customer density lateral devices were mapped, patrolled, and prescribed reliability trimming executed by tree crews.



Example –High customer density LLN`s Two spans overhead lateral serve an underground primary loop.

- 1st
- 2nd

DDB	OH Primary Miles	Customer Count	Customers per Mile
5-5813-1159-0-5	0.02	182	9100
5-5813-1155-0-6-W	0.01	51	5100



Trimming and herbicide application on .13 mile OH lateral will protect 233 UG customers from vegetation outages.



PRIORITIZED COUNTERMEASURES

<u>Root Cause</u>	<u>Countermeasures</u>
<ul style="list-style-type: none"> • All Lateral devices have the same selection criteria regardless of customer density. • All lateral devices trimmed in prior 3 years are excluded from Planned Maintenance selection regardless customer density. 	<p>1st</p> <ul style="list-style-type: none"> • Identify and patrol TB lateral devices greater than 286 customers per over head mile. <p>2nd</p> <ul style="list-style-type: none"> • For high customer density lateral devices, patrol and trim imminent tree conditions likely to cause outage within 1 year regardless of last trim date.

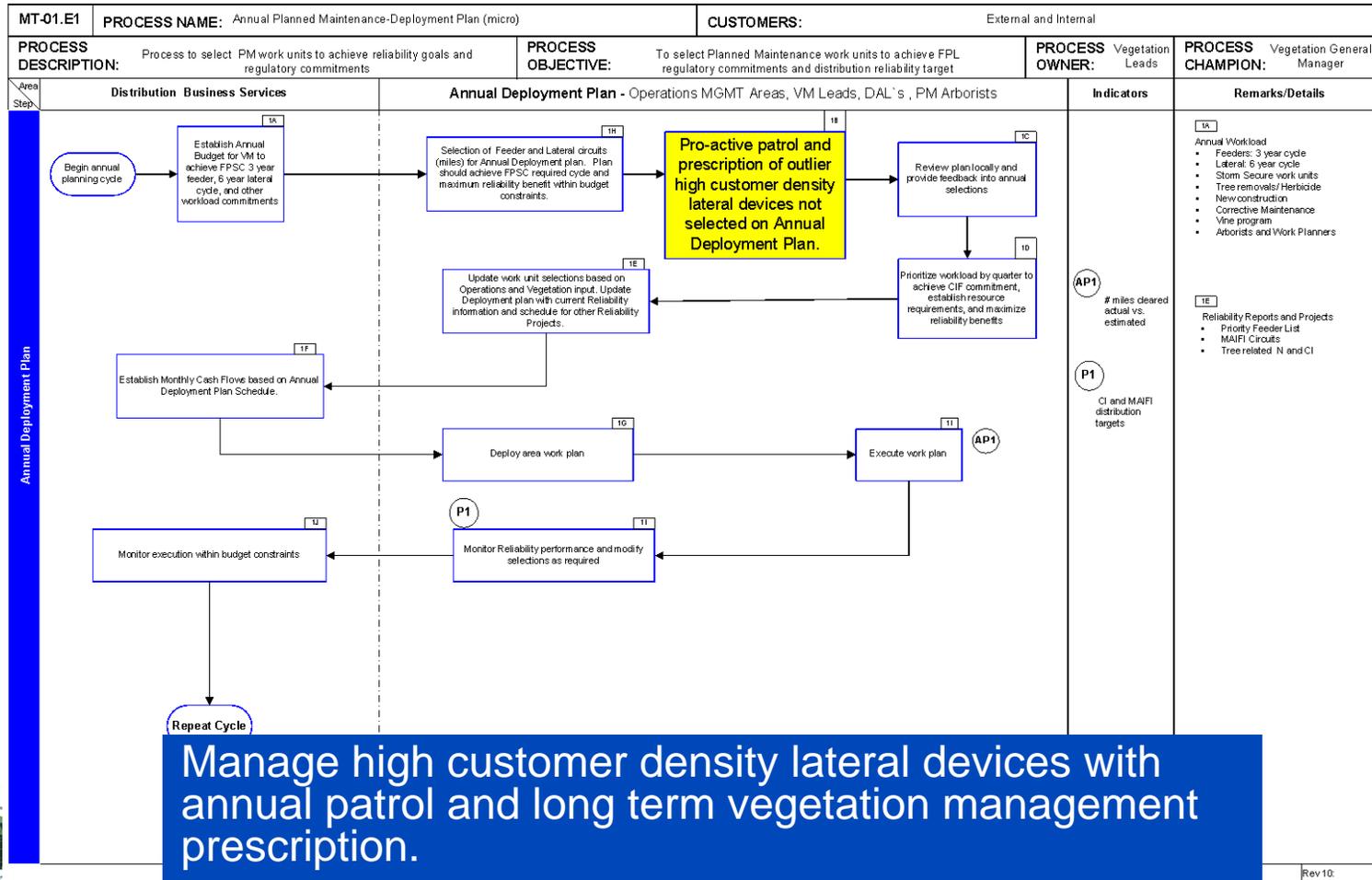


Lateral devices with CI/OH Mile greater than 2 sigma from mean should be inspected annually for imminent tree conditions.



What is the desired-state process that incorporates your countermeasures?

Proactively manage vegetation on outlier high customer density lateral devices.

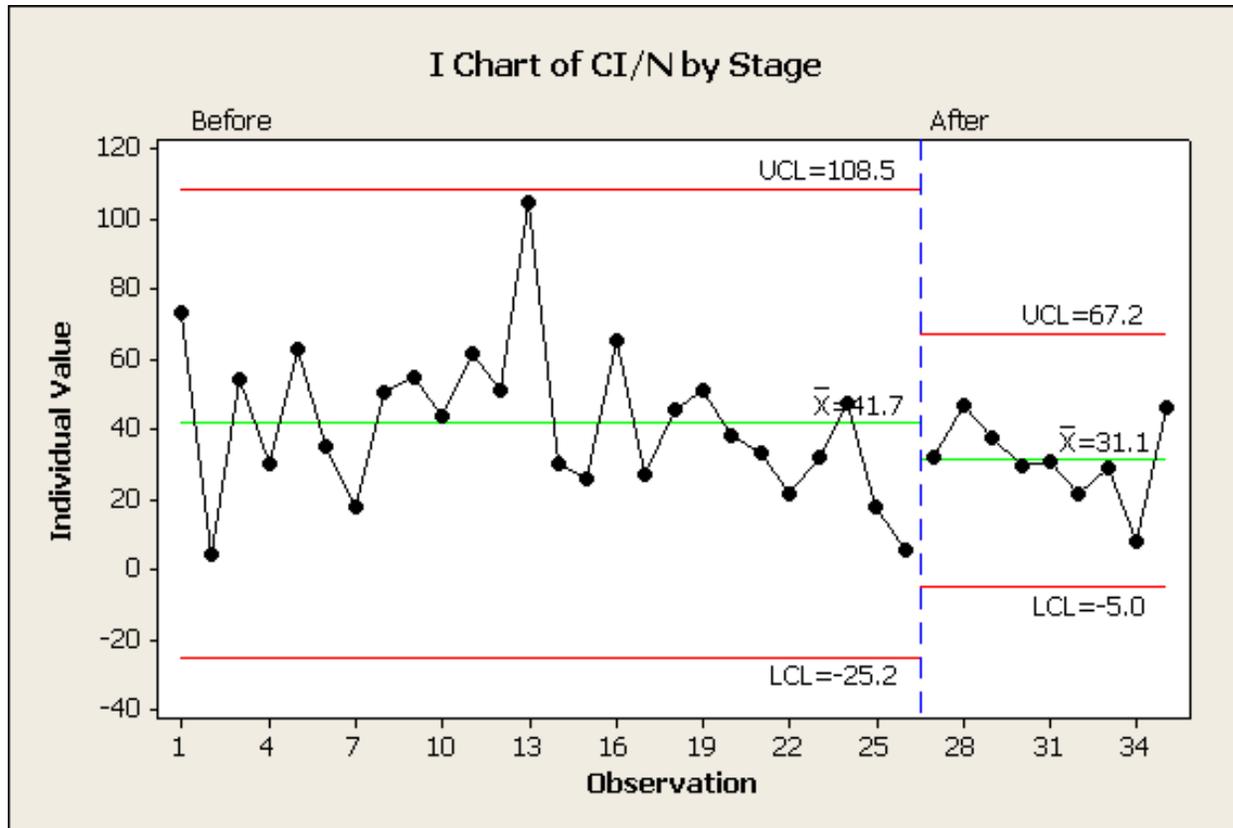


Manage high customer density lateral devices with annual patrol and long term vegetation management prescription.



Is the new process stable and in control?

TB CI/N Before/After Stages Control Chart

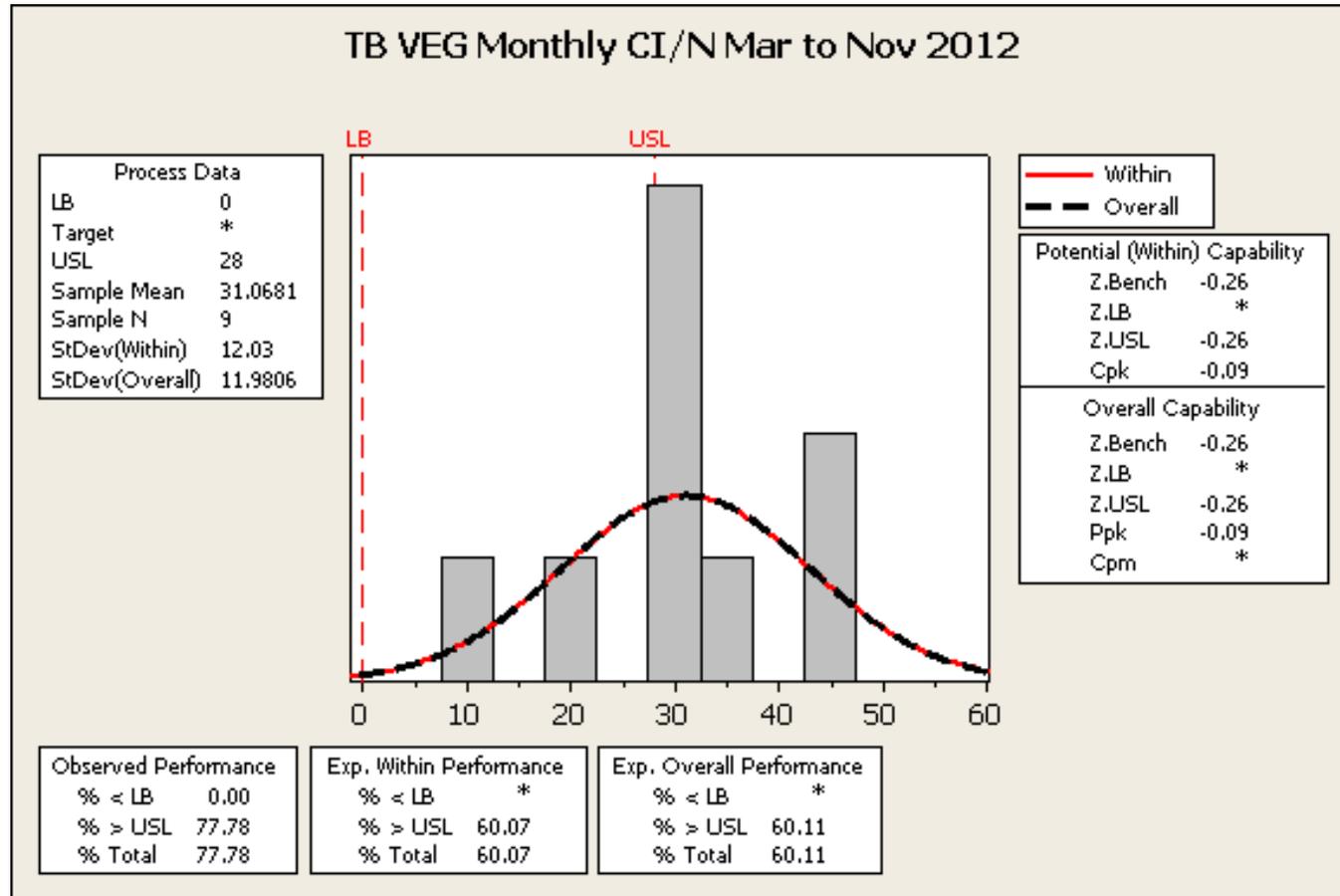


Mean CI/N for TB lateral circuit is stable and in control.
 The mean TB VEG CI per N decreased from 42 to 31 for circuits where countermeasures were executed.



How has the process performed after your improvements?

TB VEG CI/N

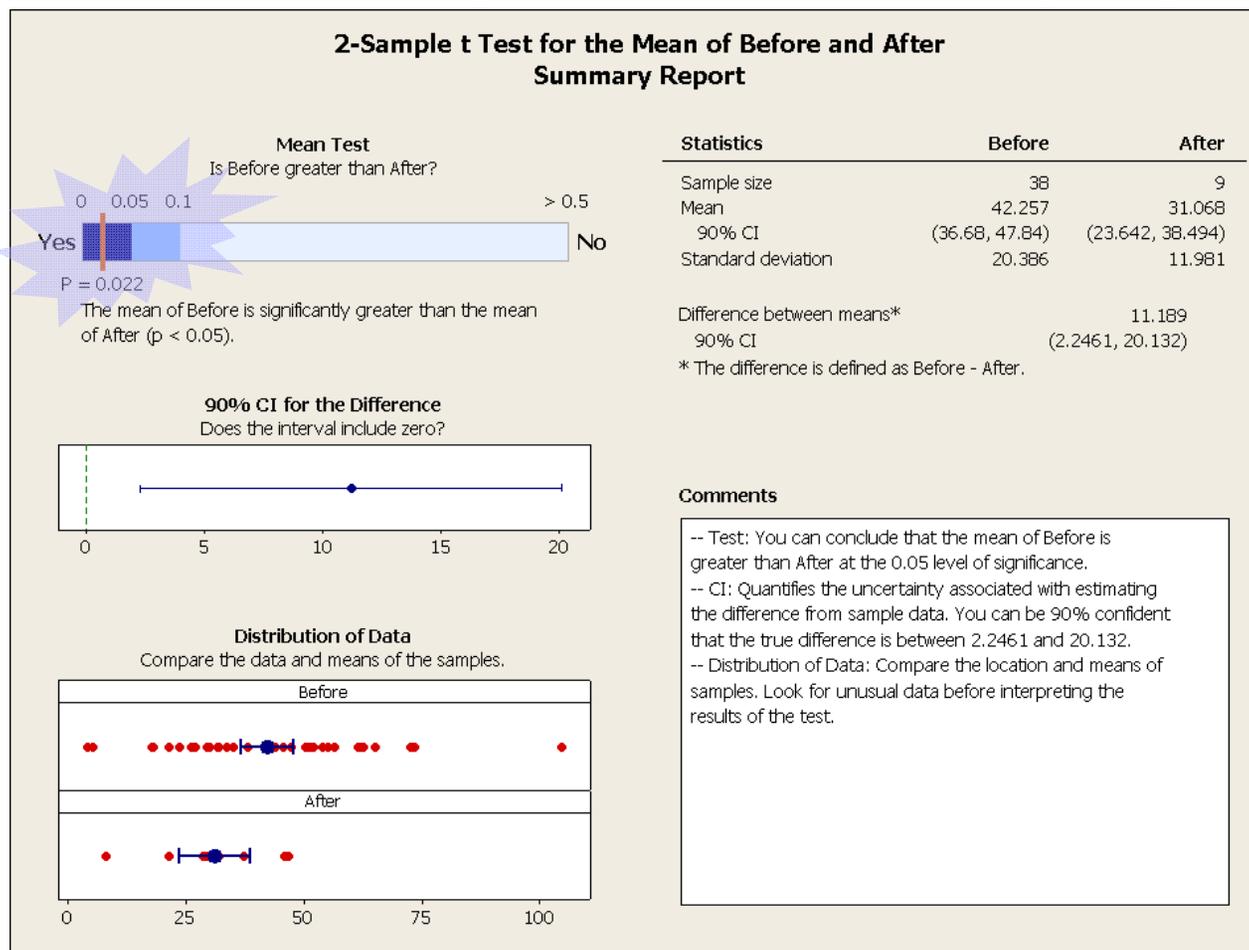


The process is 23% capable of performing within the upper spec limit.



What is the statistical significance of your improvement?

The reduction in TB Veg CI/N is statistically significant.

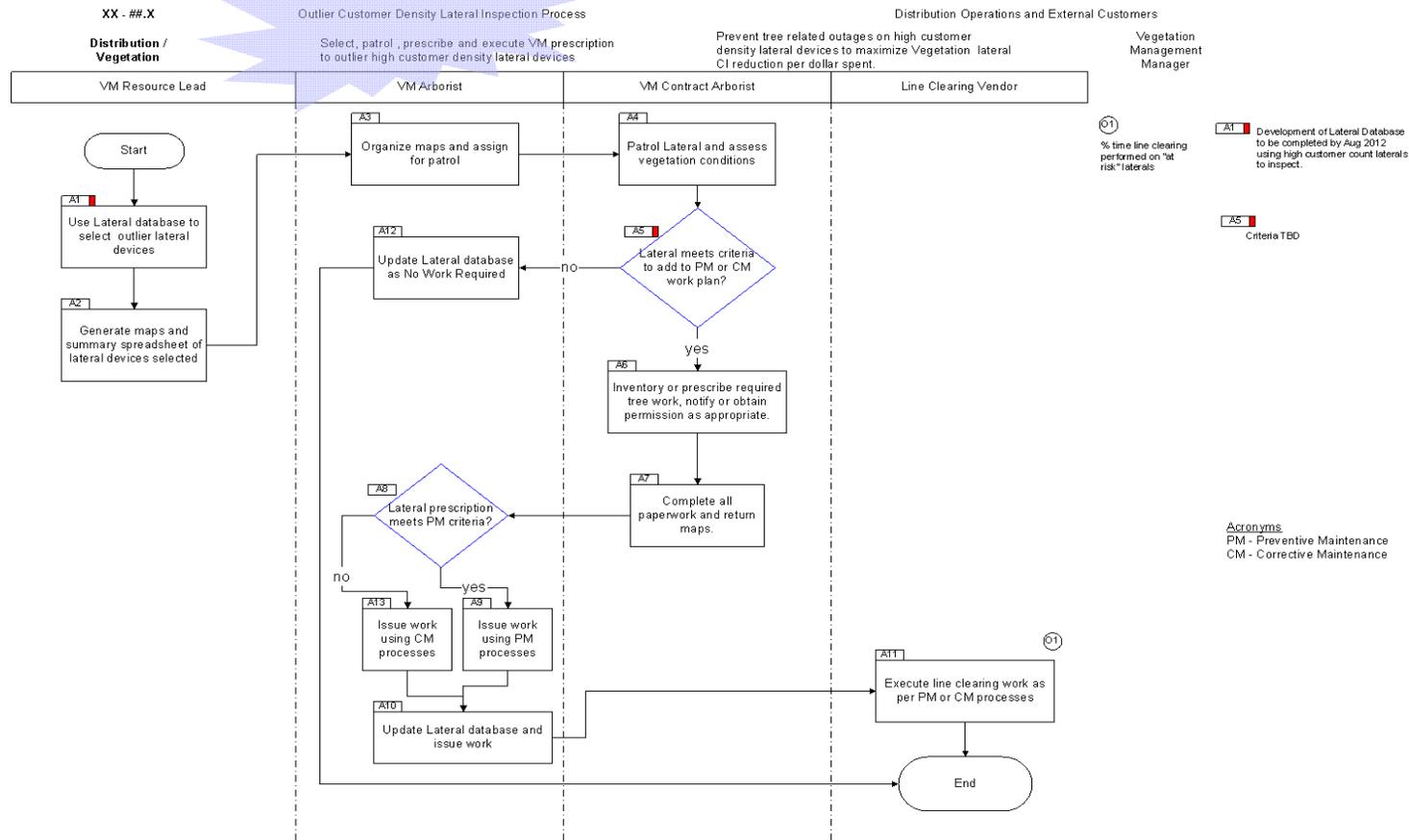


As the P value less than .05, the improvement is statistically significant.



What controls are in place to sustain your results?

VM Outlier Customer Density Process Flow Chart



Deploy process to map, patrol and execute imminent tree conditions on outlier customer density lateral devices.



What controls are in place to sustain your results?

Deploy Process Control Plan

Process Step	What's Controlled?	Input or Output?	Spec. Limits / Requirements	Measurement Method	Control Measure	Sample Size	Frequency	Who/What Measures	Where Recorded	Decision Rule/ Corrective Action
Selection of worst performing laterals	Work Units selected	Output	Customer Density > 2 sigma from mean	GIS Query	Monthly Lateral Miles execution	100%	Annual	Veg Analysts	SharePoint	Set threshold of High Customer Density laterals
Mapping of High Customer Density lateral devices	Standard Map product	Output	Map product meets VM expectation	Manual	Validate all Maps requested are created	100%	Constant	VM Arborist	SharePoint	Update Lateral mapping requirements
Patrol of High Density Laterals	Work scope objectives	Input	Vegetation at imminent risk of outage	Manual	Veg CI/N	100%	Annual	Veg Analysts	SharePoint	Define patrol Objectives
Execution of Tree work	Completed work meets VM quality expectations	Output	95% quality rating	Rework sites	Supplier quality score	100%	Constant	VM Arborist	SharePoint	Establish guidelines for outlier laterals
Record Trim History in LLN database	Trim History	Input	100 % of patrolled laterals	Manual	WMS report	100%	Constant	VM Arborist	SharePoint	Create lateral device database

Update VM Annual Deployment Plan lateral selection process to include patrol of outlier customer density lateral devices.



What is your plan to transition the new process back to the process owner?

Return ownership to Regions

- Each Region has established Vegetation CI targets.
- VM Resource Specialist to maintain list high customer density laterals for patrol by Region.
- VM Resource Specialist to build database to track patrol and trim history on high customer density laterals.
- Each Region has ability to issue high customer density lateral devices to reduce lateral CI.



Allow VM Regional Leads select lateral devices to achieve reliability targets within their regions.

What was the actual business or customer impact of your project?

Business Impact

(Projected given actual results from new process)

Net Value Calculator

This file contains an example already built in to it which refers to instructions that are also down-loadable from the Corporate Quality Website. Many cells are protected but you can format them and delete the example. Please save the file on your computer under a new name for making entries specific to your project.

Project Name: **Reduce Vegetation CI in Toledo Blade**

Prepared by: **Sample Originator: Barry Grubb**

Costs

Columns 1 - 6: Worksheet area for listing estimated implementation costs						Columns 7 - 12: Projected COSTS Up-front and/or over Several Years					
1 - List Financial Costs Here Briefly Describe your customer service or corrective activities that involve costs	2 Type of Cost Impact	3 Capital or Expense	4 Quantity No. of Units per	5 Annual Cost per Unit	6 Annualized Amount \$	7 Up-front Cost	8 Year 1	9 Year 2	10 Year 3	11 Year 4	12 Year 5
Teamhour	DD	Expense	75	\$ 49.00	\$ 3,675.00	\$ 3,675.00	\$ -	\$ -	\$ -	\$ -	\$ -
Total Estimated Costs						\$ 3,675.00	\$ -	\$ -	\$ -	\$ -	\$ -

Savings

Columns 1 - 6: Worksheet area for listing estimated savings						Columns 7 - 12: Projected SAVINGS Up-Front and/or over Several Years					
1 - List Financial Savings Here Briefly Describe your customer service or corrective activities that involve savings/benefits	2 Type of Savings	3 Capital or Expense	4 Quantity No. of Units per	5 Annual Savings per Unit	6 Annualized Amount \$	7 Up-front Savings	8 Year 1	9 Year 2	10 Year 3	11 Year 4	12 Year 5
Selecting High Customer density lateral reduce CI/H	DD	Expense	154	\$ 35.00	\$ 5,390.00	\$ -	\$ 5,390.00	\$ 5,390.00	\$ 5,390.00	\$ 5,390.00	\$ 5,390.00
Total Estimated Savings						\$ -	\$ 5,390.00				

NET PRESENT VALUE (NPV) OF PROJECT (After-Tax)

Discount Rate (%) as of: 02.08

8.35%

Tax Rate (%) as of: 02.08

33.33%

NPV of Total Project

\$10,731.43

The Tax and Discount Rates (at left) may change subsequent to initial findings. Upon approval to implement the Project, please ensure that your NPV is refreshed with the latest discount and tax rates (available from the Financial Business Unit Website). Please post or update the latest NPV to your Project Charter.

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Net Present Value of \$10,731



How did you ensure that the business will reap the maximum amount of benefits from your project learnings?

Plans for replication and other opportunities

Replication Actions:

- Share Regional lists of lateral devices with customer density greater than 2.5 sigma from the Regional mean with VM Leads and Delivery Assurance Leads.

Actions to follow up on other project learnings:

- Define project scope and obtain funding to develop GIS application and database to manage lateral devices using customer density, historical reliability data, facility attributes, trim history, and vegetation density to better manage vegetation on lateral distribution system.



Customer Density is one of several attributes that can help us better manage reliability of distribution system.

Project Completion Approvals

<i>Approver</i>	<i>Printed Name</i>	<i>Signature</i>	<i>Date</i>
<p>Special Instructions</p> <ul style="list-style-type: none"> •Print this signature slide •Obtain written signatures •Scan signed page and paste the image over the top of the blank content on this page •Post your updated presentation to PowerSteering •Submit your project to your QDL for approval in PowerSteering •Delete this box when complete 			
Project			
Quality			
Process			
Process			

