City of Lake Stevens Vision Statement

By 2030, we are a sustainable community around the lake with a vibrant economy, unsurpassed infrastructure and exceptional quality of life.

CITY COUNCIL WORKSHOP MEETING AGENDA

100% Virtual – Via Zoom

Tuesday, October 5, 2021 at 6:00 p.m.
https://us02web.zoom.us/j/82778742288
or call in at (253) 215-8782
Meeting ID: 827 7874 2288

- Joint Workshop with Lake Stevens Sewer District - Department of Ecology Draft Puget Sound Nutrient General Permit:
  Eileen Canola, Senior Planner, Snohomish County Planning & Development
  Jeff Clarke, Commissioner Mukilteo Water and Wastewater District & WASWD Representative on the DOE General Permit Advisory Committee
  Barry Baker, Engineer, Gray & Osborne

- Growth Allocations - David

THE PUBLIC IS INVITED TO ATTEND BUT WILL NOT BE ALLOWED TO COMMENT

Special Needs

The City of Lake Stevens strives to provide accessible opportunities for individuals with disabilities. Please contact Human Resources, City of Lake Stevens ADA Coordinator, (425) 622-9400, at least five business days prior to any City meeting or event if any accommodations are needed. For TDD users, please use the state's toll-free relay service, (800) 833-6384, and ask the operator to dial the City of Lake Stevens City Hall number.

NOTICE: All proceedings of this meeting are recorded, except Executive Sessions.

Nutrient Permit Overview

Jeff Clarke, WASWD representative on the PSNGP Advisory Committee

Issue:
Proposal for a General Permit on wastewater treatment plants, incurring additional regulations.

Permitting Agency:
Washington Department of Ecology

Facilities Involved:
58 public wastewater treatment facilities discharging directly into Puget Sound
Does not include facilities discharging to rivers leading to Puget Sound

Substance of Concern:
Nutrients—mainly Nitrogen

Reason:
Concern that excessive nutrients are leading to plant growth that depletes oxygen
Low dissolved oxygen levels in marine waters are thought to negatively affect marine life—orca, salmon, et al

Permit Overview:
The 58 plants already have individual Ecology permits which regulate:

- Monitoring/testing
- Operations
- Effluent quantity and quality

DOE wants a General Permit placing standardized rules on these plants
Individual permits would remain in place, working together with General Permit

Background:

- Nutrients have been an issue under study for >20 years
- The Pacific Ocean is the largest source of nutrients entering Puget Sound
- Wastewater plants are believed to contribute a majority of "anthropomorphic" (man-made) nutrients
- Surface water runoff is also a major contributor
- Ecology has consistently granted individual permits without nutrient controls
- Northwest Environmental Advocates has sued the State, claiming:
    - Treatment plants are polluting Puget Sound
    - Ecology is not complying with Clean Water Act
- Ecology has a computer model which they claim shows unacceptable impacts that forms the basis for the permit conditions

Advisory Committee Process:

- Ecology made decision in January 2020 to develop a General Permit
- Ecology formed Advisory Committee in early 2020
- Representatives from utilities, environmental groups, state and federal agencies
- Meetings began in April—all virtual
- Recommendation developed in October 2020—opposed by utilities
- Draft Permit released in June 2021
- Comment period closed August 2

Likely General Permit Conditions:

- Increased monitoring: substances and frequencies
- Interim measures to "optimize operations"
- Facility improvement plans
- Nutrient level thresholds requiring facility improvements

Issues:

- The basic science is in question; a number of Sound experts dispute Ecology
- The computer model makes rough approximations of a complex ecosystem; technical experts outside Ecology say its conclusions are misleading
- The AC process was rushed, under COVID conditions, and clearly targeted at a desired outcome
- The "current level" caps would remove planned and constructed capacity from existing plants, creating Growth Management issues
- Facilities that were built to handle projected regional growth might not be allowed to accept those new customers
- Many facilities would require major facility expansions/upgrades at significant expense
- Tacoma projects costs > $1 billion
- King County projects capital costs > $10 billion; monthly rate would go from $45 to $240 over ten years

Status:

- Ecology is working to respond to comments on the draft
- City of Tacoma and Alderwood District have jointly sued to prevent the General Permit
    - Facilities are not supposed to be covered by both general and individual permits
    - Ecology is engaging in "rule-making" without going through the required process
    - Ecology did not provide for adequate public input

Questions:

- Is the computer model accurate? Does it fairly portray the natural system?
- Is this solution the best use of public dollars to solve the problem?
- Is the problem in Puget Sound—or in narrow inlets? And do Central and North Sound plants really affect Budd Inlet? Should solutions be targeted rather than widespread?

Overview of the Draft Puget Sound Nutrient General Permit (Dominant Loaders)

Anne Conklin: E: aconklin@carollo.com P: 206.538.5152
Tadd Giesbrecht: E: tgiesbrecht@carollo.com P: 206.538.5836
Dave Price: E: dprice@carollo.com P: 206.940.9816

carollo

2021 | 2022 | 2023 | 2024 | 2025 | Ongoing >

Nitrogen Optimization Plan

- Best management practices (BMP) to stay below Action Level (AL)
- Minimal capital investments – focus on operational strategies
- Process Modeling

5/1 — Initial Selection
3/31 — Initial Implementation

Total Inorganic Nitrogen (TIN) Exceeds Action Level

Requires implementation of additional measures identified in the Nitrogen Optimization Plan when AL exceeded 2 years in a row, or 3rd year during permit term. Prepare abbreviated Engineering Report/TM for 10% reduction to be implemented within 5 years.

1. Select Additional Optimization Strategy — Strategy implementation prior to submittal of next annual report. TBD
2. "Eng. Report/TM to Reduce TIN by 10%" — Implement measures described in abbreviated Eng. Rpt/TM w/in 5 years. TBD

Ongoing Requirements

- Load Evaluation
  - TIN effluent data review
  - Assess TIN removal rates
- Strategy Assessment
  - Assess effectiveness of implemented optimization strategy
  - Identify improvements to strategy
- SourceControl
  - Ongoing program to reduce influent TIN
  - Identify pretreatment possibilities

3/31 Load Evaluation
3/31 Load Evaluation
3/31 Load Evaluation
3/31 Strategy Assessment
3/31 Strategy Assessment
3/31 Strategy Assessment

N — Influent Nitrogen Reduction Measures/ Source Control Program

Nutrient Reduction Evaluation (NRE)

Analysis must be sufficiently complete that an Engineering Report can be developed for the preferred alternative.

- AKART Analysis
- Develop options to achieve 3 mg/L TIN
- Wastewater Characterization
- Treatment Technology Analysis
- Economic Evaluation
- Environmental Justice (EJ) Review

12/31

Ecology Activities

Conduct Salish Sea Modeling (SSM) to establish WQBELs.

Year 1 SSM Report — Annual vs. Seasonal
Year 2 SSM Report — Draft WLAs
Draft Plan
Develop Draft WQBELs
Final Draft WQBELs

Ongoing planning (permitting strategies), design, and construction of capital investments to achieve water quality-based effluent limits (WQBELs). Efforts should assess "watershed" based solutions.

09/02/2021

Overview of the Draft Puget Sound Nutrient General Permit (Small Loaders)

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Dave Price: E: dprice@carollo.com P: 206.940.9816

carollo

2021 | 2022 | 2023 | 2024 | 2025 | 2026 | Ongoing >

Nitrogen Optimization Plan

- Minimal capital investments – focus on operational strategies
- Treatment Process Performance Assessment
- Load Evaluation
  - TIN effluent data review
  - Assess TIN removal rates
- Strategy Assessment
  - Assess effectiveness of implemented optimization strategy
  - Identify improvements to strategy
- Source Control
  - Ongoing program to reduce influent TIN
  - Identify pretreatment possibilities

12/31 | TBD | 3/31

- Initial Selection
- Implementation During the Reporting Period
- Submit Nitrogen Optimization Plan
- Load Evaluation
- Strategy Assessment
- Influent Nitrogen Reduction Measures/ Source Control Program

AKART Analysis

Evaluate reasonable treatment alternatives capable of reducing TIN.

12/31

- AKART Analysis
- Wastewater Characterization
- Treatment Technology Analysis
- Economic Evaluation
- Environmental Justice (EJ) Review

Ecology Activities

Conduct Salish Sea Modeling (SSM) to establish WQBELs.

- Year 1 SSM Report: Annual vs. Seasonal
- Year 2 SSM Report: Draft WLAs
- Draft Plan
- Develop Draft WQBELs
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Ongoing planning (permitting strategies), design, and construction of capital investments to achieve water quality-based effluent limits. Efforts should assess "watershed" based solutions.

Snohomish County Capital Facilities & Utilities Planning

Lake Stevens Sewer District / City of Lake Stevens Joint Meeting

October 5, 2021

Overview

- Ecology Puget Sound Nutrient General Permit
- Capital Facilities and Utilities
  - State Requirements
- 2024 Comp Plan Update
  - Updating for the 20-year horizon to 2044
  - Includes Capital Facilities & Utilities planning

Snohomish County

S4. REQUIREMENTS FOR WWTPS WITH DOMINANT TIN LOADS

The discharge limits in S4 are described above in *Rationale for Narrative Water Quality-Based Effluent Limitations* and *Consideration of Narrative Water Quality-Based Limits for Numeric Criteria.*

ACTION LEVEL CALCULATION

This draft permit proposes a total inorganic nitrogen action level for each of the permittees listed in Condition S4, which constitute 99% of the current domestic point source anthropogenic load. The action level, AL_0, forms the baseline value representing current TIN

DRAFT Puget Sound Nutrient General Permit Fact Sheet Page 40

Puget Sound Nutrient General Permit Advisory Committee Report Out & Emerging Nutrient Technologies

Puget Sound Nutrient Forum Meeting
November 3, 2020

DEPARTMENT OF ECOLOGY

Snohomish County

Topics Discussed

Cap/Target

- Calculation
- Expression
- Compliance

Planning

- Optimization
- Short Term
- Long Term

Monitoring

- Parameters
- Frequency

Permit Overlay

- Managing duplicate requirements
- Implementation and Management

In the middle

Completing the modeling, the plan, and the permit

2020

Nutrient Forum and Nutrient General Permit

- Formal decision to develop the NGP
- NGP Advisory Committee
- Draft Outline of Puget Sound Nutrient Reduction Plan

2021

Continued Forum and NGP

- Year 1 scenario model results and Year 2 scenario input
- Draft Nutrient Reduction Plan Chapters
- NGP- First permit issuance
- Watershed implementation strategy discussions

2022-2023

Modeling and the Plan

- Year 2 results
- Draft Nutrient Reduction Plan public review

2026

Nutrient General Permit & Plan Implementation

- Second permit issuance with WQBELs
- Draft Nutrient Reduction Plan public review

GMA Planning Goal

GMA Planning Goal 12:

(12) **Public facilities and services.** Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.

Snohomish County

GMA Requirement – Comprehensive Plan

RCW 36.70A.070 Comprehensive plans—Mandatory elements.

(3) A capital facilities plan element consisting of:

(a) An inventory of existing capital facilities owned by public entities, showing location and capacity;

(b) a forecast of the future capital facility needs;

(c) the proposed locations and capacities of expanded or new capital facilities;

(d) at least a six-year capital facility financing plan that clearly identifies sources of public money; and

(e) A requirement to ensure consistency between the land use element, capital facilities plan element, and capital facilities financing plan, and a requirement to reassess land use element if funding falls short to meet existing needs.

(4) A utilities element containing the general location, proposed location, and capacity of all existing and proposed utilities, including, but not limited to, electrical lines, telecommunication lines, and natural gas lines.

Snohomish County

GMA Requirements for Updating Comprehensive Plan

- **RCW 36.70A.130: Snohomish County & cities/towns are required to:**

★ Plan for the succeeding 20-year population and employment growth forecast; and

★ Review and revise their comprehensive plans and development regulations to ensure the plan and regulations comply with the requirements of the GMA.

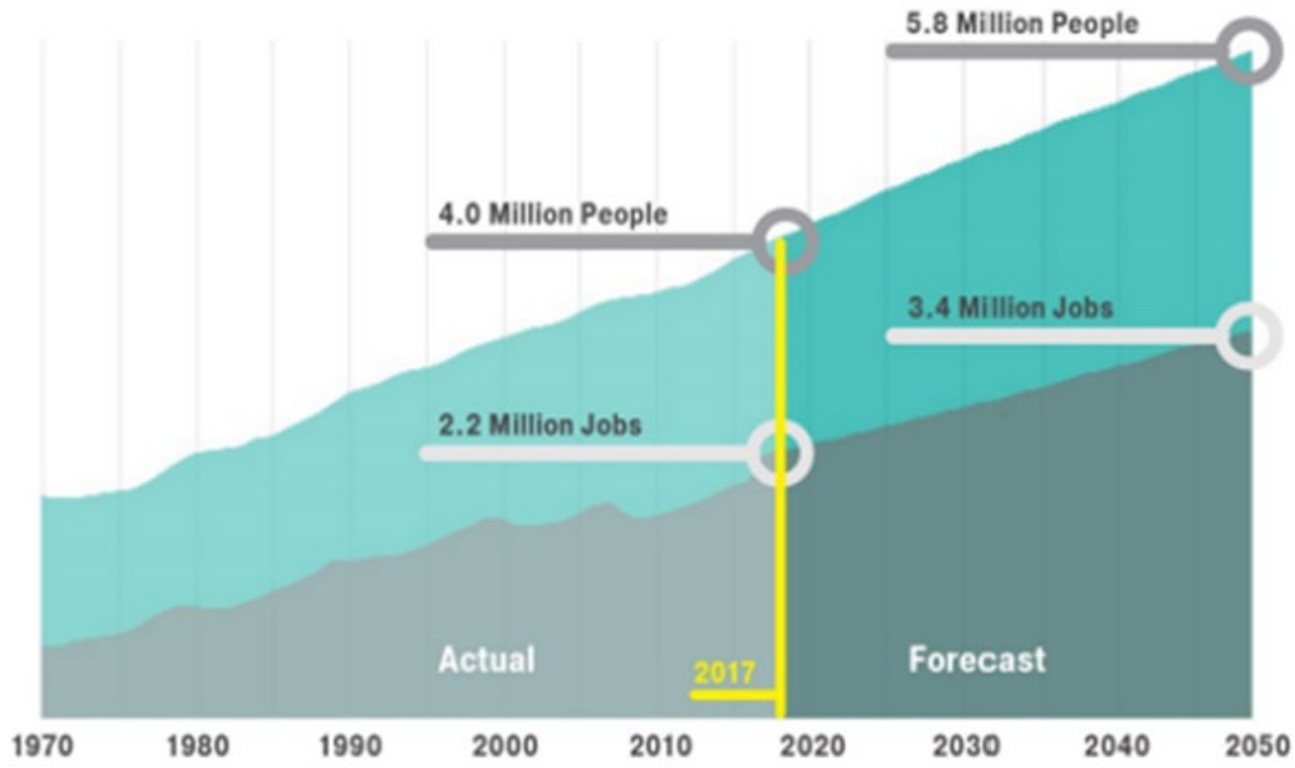
- **June 30, 2024, deadline to complete the update**

Snohomish County

Regional Growth

The region is expected to grow by 1.8 million people by 2050, reaching a total population of 5.8 million. An anticipated 1.2 million more jobs are forecast by 2050. The region's population in 2050 will be older and more diverse, with smaller households than today. Planning for this much growth is difficult, and VISION 2050 recognizes that local, state, and federal governments are all challenged to keep up with the needs of a growing and changing population.

Figure 2 – Historic and Forecast Growth



VISION 2050

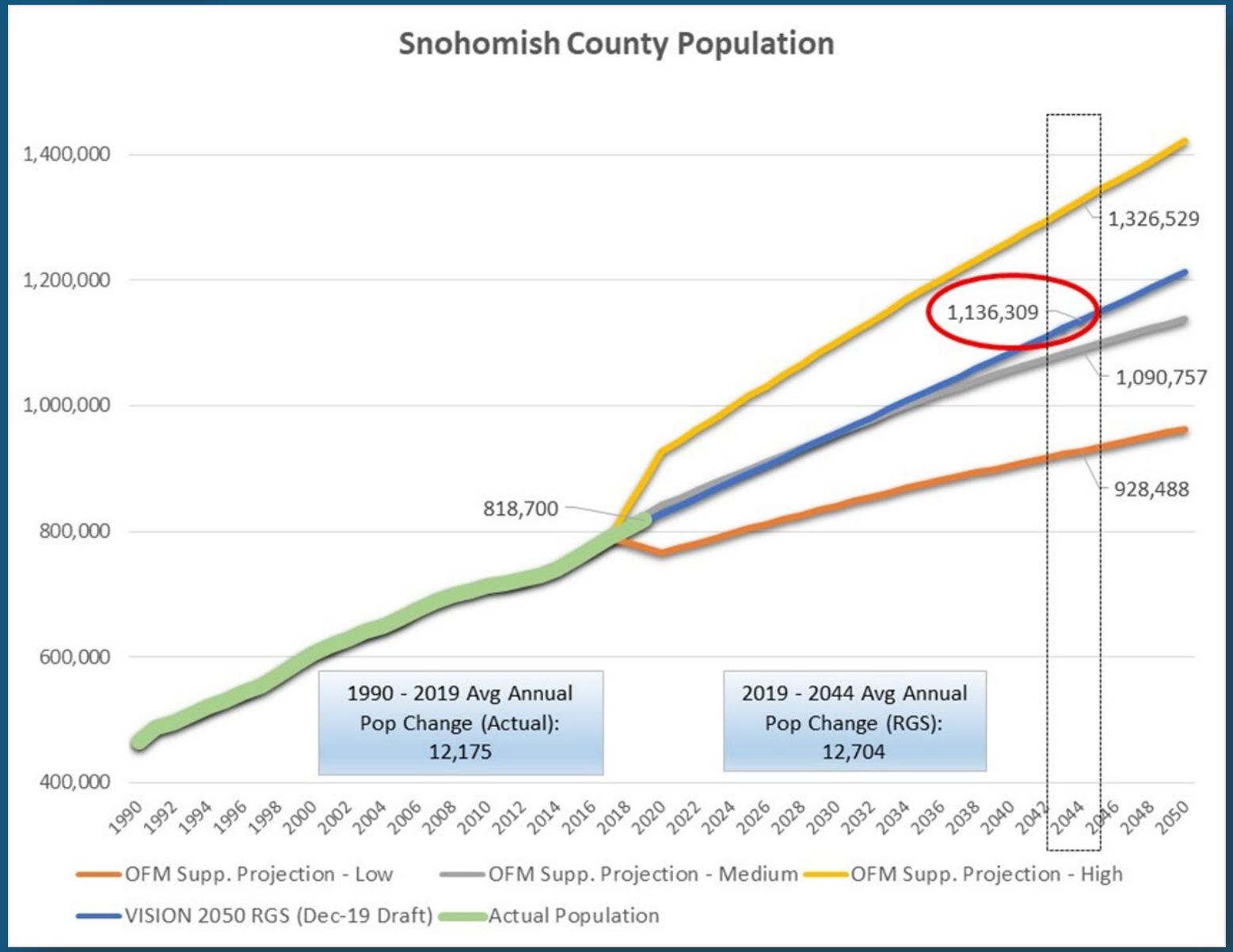
Puget Sound

By 2050

- expected to grow by 1.8 million people
- Forecast of 1.2 million more jobs

Snohomish County

2044 Growth Targets



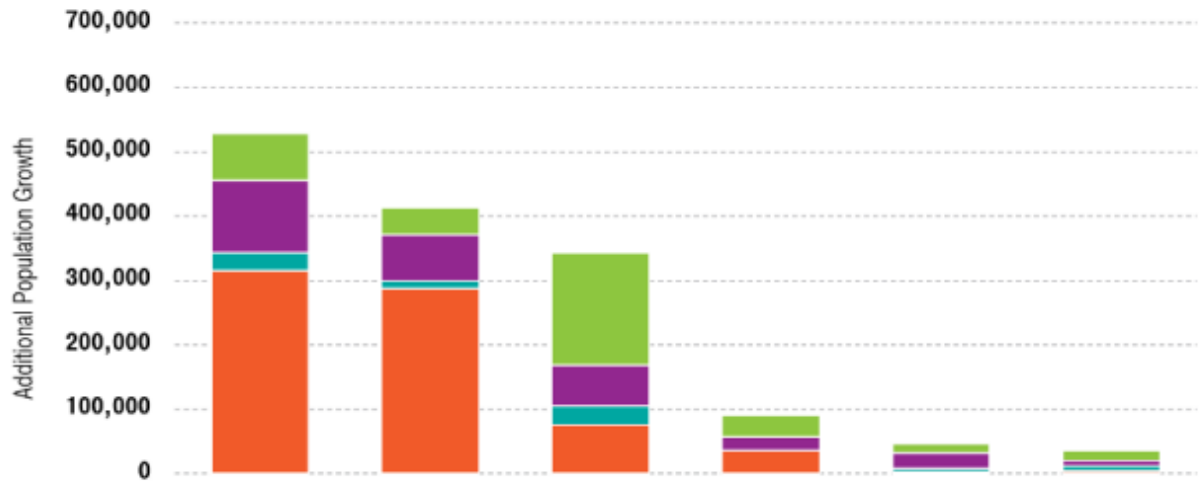
- By 2044 countywide population of 1,136,309 per PSRC VISION 2050 Regional Growth Strategy
- Population increase of 291,909 between 2021 and 2044 *(844,400 county pop as of April 1, 2021)*.
- 95.5% of the future population directed to Urban Growth Areas

Snohomish County

Regional Growth Strategy

Figure 1 Regional Growth Strategy — Population Growth 2017–2044 (Illustrative)

Puget Sound Regional Council



County	Metropolitan Cities		Core Cities		High Capacity Transit Communities		Cities & Towns		Urban Unincorporated		Rural	
King	316,000	44%	288,000	40%	76,000	11%	36,000	5%	3,000	0%	5,000	1%
Kitsap	27,000	34%	12,000	16%	29,000	36%	-	0%	5,000	6%	7,000	8%
Pierce	113,000	38%	71,000	23%	64,000	21%	21,000	7%	24,000	8%	9,000	3%
Snohomish	72,000	20%	42,000	12%	174,000	50%	34,000	9.5%	15,000	4%	15,000	4.5%

- GMA Planning Goal 12:
- (12) Public facilities and services. Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.

Planning Framework

Growth Management Act (GMA)

↓

Vision 2050 / Multi-county Planning Policies / Regional Growth Strategy

↓

Countywide Planning Policies (CPPs)

↓

Snohomish County Comprehensive Plan

- General Policy Plan
- Capital Facilities Plan
- Transportation Element
- Parks and Recreation Element

Snohomish County

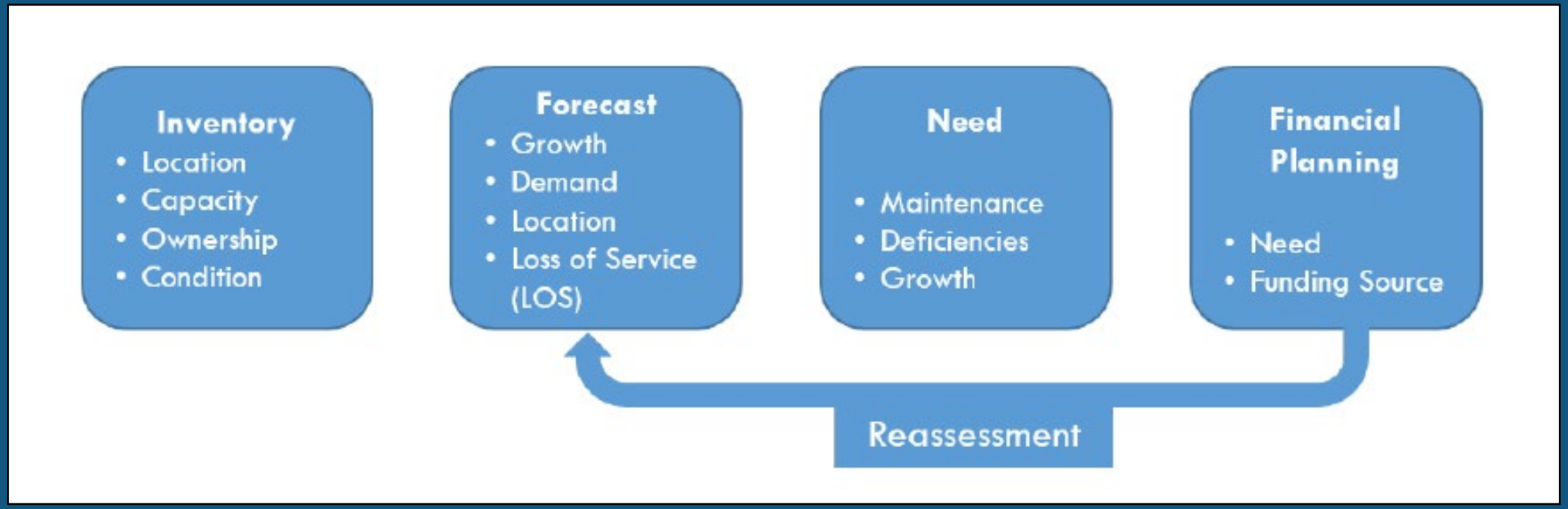
GMA Requirement – Comprehensive Plan

RCW 36.70A.070 Comprehensive plans—Mandatory elements.

- Land Use Element
- Housing Element
- Capital Facilities Plan Element
- Utilities Element
- Rural Element
- Transportation Element
- Economic Development Element
- Parks and Recreation Element

Snohomish County

GMA Requirements:
Capital Facilities and Utilities Elements



Snohomish County

Capital Facilities and Utilities Planning

- **General Policy Plan:** Policy framework
- **Capital Facilities Plan - For county and non-county services and facilities:** Forecast of future needs, list of inventories, map of inventories, Level of Service Standards (only for those necessary to support development),
- **Annual Capital Improvement Plan**: 6-year financing plan for all county facilities and services with statement of assessment for county and non-county services necessary to support development
- **Snohomish County Code:** Implementation

2024 Comprehensive Plan *Update*

Snohomish County

Planning for a resilient, vibrant, and inclusive future

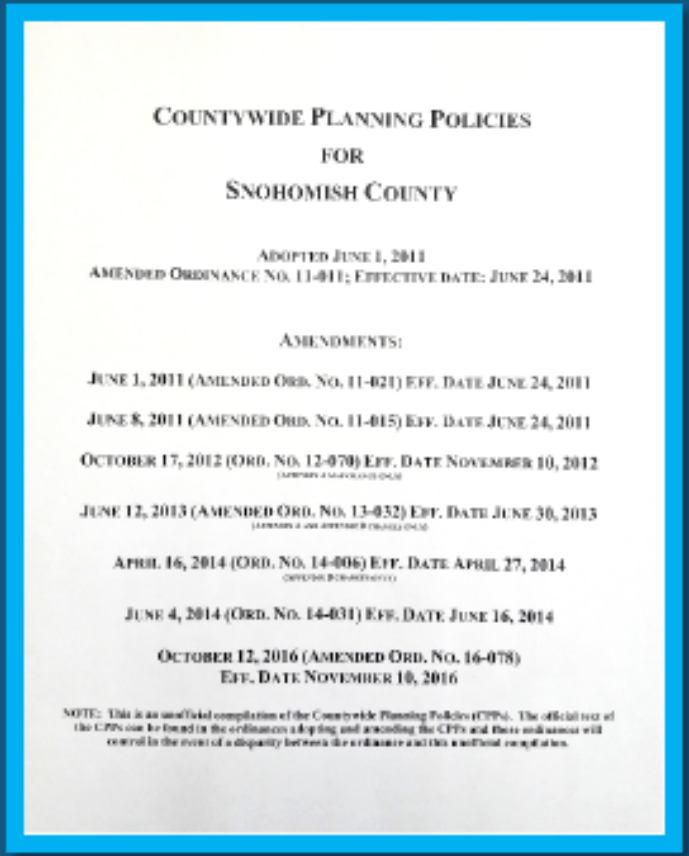
Updating the Capital Facilities & Utilities Element

- Introductory / Background: Regional Growth Strategy, CPPs, Growth Targets
- Existing Inventories
- Forecast of Future needs to 2044
- Maps
- Level of Service Standard (LOS)
- Referencing Transportation Element and Parks and Recreation Element
- Coordinating with Outside Service Providers

Snohomish County

Countywide Planning Policies – Areas of Emphasis

- Climate Change
- Social Justice/Equity
- Tribal Coordination
- Annexations
- Missing Middle Housing
- Open Space
- Affordable Housing
- Displacement



COUNTYWIDE PLANNING POLICIES
FOR
SNOHOMISH COUNTY

ADOPTED JUNE 1, 2011
AMENDED ORDINANCE NO. 11-011; EFFECTIVE DATE: JUNE 24, 2011

AMENDMENTS:

JUNE 1, 2011 (AMENDED ORD. NO. 11-021) EFF. DATE JUNE 24, 2011

JUNE 8, 2011 (AMENDED ORD. NO. 11-015) EFF. DATE JUNE 24, 2011

OCTOBER 17, 2012 (ORD. NO. 12-070) EFF. DATE NOVEMBER 10, 2012

JUNE 12, 2013 (AMENDED ORD. NO. 13-032) EFF. DATE JUNE 30, 2013

APRIL 16, 2014 (ORD. NO. 14-006) EFF. DATE APRIL 27, 2014

JUNE 4, 2014 (ORD. NO. 14-031) EFF. DATE JUNE 16, 2014

OCTOBER 12, 2016 (AMENDED ORD. NO. 16-078)
EFF. DATE NOVEMBER 10, 2016

NOTE: This is an unofficial compilation of the Countywide Planning Policies (CPPs). The official text of the CPPs can be found in the ordinances adopting and amending the CPPs and those ordinances will control in the event of a disparity between the ordinance and this unofficial compilation.

Snohomish County

Resilience – Area of Emphasis

- Update climate change policies consistent with updated CPPs
- Update Capital Facilities Element to incorporate 2020 Hazard Mitigation Plan

Snohomish County

Concern:
Long Term Permit Requirements & Meeting GMA Requirements for Capital Facilities Planning

In the middle

Completing the modeling, the plan, and the permit

2020

Nutrient Forum and Nutrient General Permit

- Formal decision to develop the NGP
- NGP Advisory Committee
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- **June 30, 2024, deadline to complete the update**

2024 Comprehensive Plan *Update*

Questions?

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Snohomish County

LAKE STEVENS SEWER DISTRICT
Serving You Since 1957

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March 12, 2021

Eleanor Ott, PSNGP Permit Writer
Department of Ecology
Water Quality Program
PO BOX 47600
Olympia, WA 98504-7600

The Lake Stevens Sewer District (permit WA0020893) appreciates the opportunity to comment on the Puget Sound Nutrient General Permit Preliminary Draft (January 2021).

Lake Stevens Sewer District owns and operates a moderately sized, publicly owned domestic wastewater treatment plant within the General Permit Proposed Facility Coverage list. The customer base of this facility is also of moderate size. The rate base would be challenged to take on additional significant capital improvements. It is a goal of the District to keep the rates within the generally accepted 2% of median household income. The District hopes that the Department of Ecology advocates and assist in making loans and grants available to assist in meeting these new requirements that could me attainable for Districts of moderate size to meet the challenges of this general permit.

As a general principle, the District does agree that water quality is mission critical for the District. As evidence of that, the District invested in a new $120 million treatment plant facility, accepted by Ecology in 2013, that was expected to meet permit requirements for 20-30 years. The District also recognizes and accepts that there is a general order to ever increasing stringency in regulatory elements imposed to maintain water quality; however, the District holds that these regulatory elements must be based on quality, vetted scientific data. The draft general permit contradicts itself in stating that action level thresholds (AL_0/AL_1) that trigger further action are intended to "first establish a loading capacity for nutrients that will meet D.O. criteria in the marine waters of Puget Sound." If the general permit is to be used to collect the necessary complete data, then such studies should be completed to establish long-term criteria to protect the receiving waters prior to imposing changes. These protections should stay in place for the expected life cycle of capital improvements needed to meet any new regulations.

It is important to the District that Ecology acknowledges that there are six large plants covered by this permit, contributing about 77% of the total publicly owned treatment works (POTW) nutrient loading to Puget Sound. These high budget dischargers should be required to run the pilot tests to demonstrate that whatever treatment is effective, can also be efficient. Consequently, smaller budgeted dischargers would not be unduly burdened financially with unproven or highly expensive, treatment processes.

The District is also generally concerned with the speed at which the General Nutrient Permit will be implemented. The demand for testing equipment, laboratory accreditation, engineering support, and any additional operator training will bring undue pressure on the District. For example, the District's laboratory is not currently accredited to test Total Organic Carbon, TKN, or Nitrate plus Nitrite Nitrogen in

final effluent. In addition, we have not historically been testing total Ammonia, Nitrate plus Nitrite Nitrogen, or TKN in the influent. Some flexibility with testing methods would be appreciated.

In addition, the District's engineers prepared a Technical Memorandum (attached to this letter) in which the action levels set for the District are challenged in both method of calculation and resulting limits. Based on this assessment the District would request reevaluation of Ecology's specific limits, increasing AL_0 from 122,000 lbs/year to between 134,000 and 145,000 lbs/year of TIN.

The District's comments to Ecology's specific requested feedback follow:

1. *Do reviewers have feedback on whether the 95% UCL or 99% UCL is more appropriate for AL0?*

In the District's opinion, the 95% upper bound confidence interval should be used. The bootstrap with a mean-unbiased estimator population parameter builds from the supplied data, assuming a normal distribution of data points. However, the number of requisite data point will be limited, as few as 52 point per year, based on our monitoring schedule, which can adversely affect the model if a series of data points are outside the appropriate mean of the distribution set, or an asymmetrical bias may occur. Furthermore, the upper bound of the confidence interval is more critical than the lower bound due to the intention of evaluating data that may exceed the action level and not data that is less than the action level. In other words, the upper 2.5% if using a 95% UCL, is most important. Since the bootstrapping method is already more heavily based on theoretical samplings than actual sampling and is a very conservative method of statistical sampling, the 95% UCL more than compensates for the sampling variation to achieve the desired goal.

2. *Do reviewers agree with this approach proposed for plants that have existing nitrogen-related effluent limits in their individual permits?*

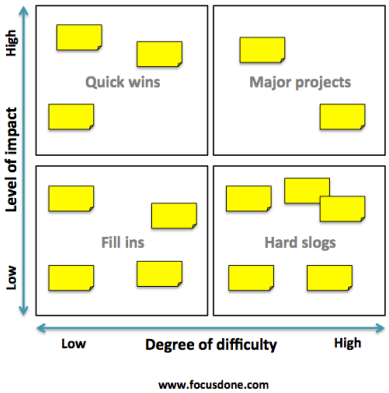
Yes, for consistency of implementation of the general nutrient permit the District accepts TIN action levels can be applied in addition to specific water quality-based nitrogen limits.

3. *Do reviewers agree with the approach proposed for calculating AL_1 for facilities that have historically been able to maintain their annual average TIN effluent concentration below 10 mg/L?*

No, since the AL_0 is to be established at 10 mg/L even facilities that have historically been below may go above during the permit cycle and should be held to the same standard of tier one actions when that occurs. Exempting these facilities from requirements beyond monitoring and optimization is a negligible reward to those facilities but a greater risk to the overall permit's goals.

4. *Do reviewers have suggestions on what information permittees use to justify their decision-making process when conducting financial and technical analyses to select (or estimate) optimization strategies?*

The District generally approaches financial and technical improvements based on their implementation difficulty and expected effectiveness (see right for a typical Lean Sigma Six priority matrix). The District also evaluates any return on investment (ROI), public impact, and regulatory need on such capital investments.



5. *Do reviewers have suggestions for "reasonable investments" at small (<3 MGD), medium (3-10 MGD) and large (>10 MGD) that could be used to separate the two tiers of optimization actions required by this permit?*

The reasonableness of the investment will depend on the skill of the operators and then on the local economical vibrancy. Reasonable investments should be reasonable, within the WWTP's budget.

6. *Are there any additional Tier 1 optimization actions that should be included in this document?*
7. *Are there any additional Tier 2 optimization actions that should be included in this document?*
8. *Are the tiers broken out appropriately?*

No comment.

9. *Ecology is soliciting input on what types of Tier 3 actions plants must take to achieve further nutrient reduction, sooner, if they exceed their second action level trigger. Should these actions vary by facility size?*

Yes, but only assuming Tier 3 actions will be more effective than Tier 1 or 2. Controlling the most egregious polluters will translate to most important environmental protections at that specific point source. Larger facilities also generally lead to a larger customer base and/or debt capacity to support such capital expenses.

10. *Do reviewers have feedback on Ecology's proposed use of a standardized form for the annual optimization report?*

A standardized form for the optimization report would be ideal. What is still unclear to the District is the level of detail expected and significance of optimization strategy attempted to be included on the report. The District's operators make minor adjustments daily based on the needs of the plant and their skill level. It would be unreasonable to document all small changes.

11. *Do reviewers have examples of information from an existing, unrelated planning process that could meaningfully apply to meet this nutrient reduction evaluation requirement?*

The District had previously worked closely with Ecology on a study at upstream and downstream of our outfall via grab samples to evaluate TIN. This type of information based on the scientific method can provide valuable information but not be based on an engineer's report or include an engineer's seal. The engineering cost can be a limiting factor to attempt remove nutrients. The District is also concerned with a limited resource that costs will go up based on demand increase.

12. *Aside from treatment solutions, do reviewers have feedback on types of questions a regional study could answer? How could a regional study like this be used to develop and/or support a nutrient trading framework?*

The general permit framework as written treats all plants as equal contributors to the DO impact in Puget Sound. However, a regional study broken down by smaller tributaries could, along with DO studies in those waterways, lead to a more thorough understanding of the effects of the individual point sources. For instance, the District's outfall into Ebey Slough (Snohomish River) could be compared to data from DOE's rivers and streams biological monitoring data to get a more complete picture of smaller mixing zones and the contributing point sources within the larger Salish Sea model. The goals of this would be to determine the most detrimental point-sources in the overall model and direct regulatory controls and funding for improvements to those projects.

13. *Do reviewers prefer one approach to a regional study over the other Ecology is soliciting specific feedback on how to develop permit requirements for a regional study that advances understanding of treatment upgrades by building on existing bodies of knowledge related to nutrient treatment processes.*

Again, the District is compelled to reiterates that using permit requirements with penalties is contradictory to monitoring and collecting data for a study. Perhaps a better way is to create an incentive like the Washington Energy Consortium (WEC) and have a Nutrient Reduction Forum.

14. *Do reviewers have feedback on whether a regional study should be limited to WWTPs <10 MGD so that larger facilities can conduct their own evaluation? Or, should Ecology provide minimum elements that must be satisfied leaving participation up to each discharger?*

The District believes Ecology should be the driver on study design and data processing for consistency. The information can then be properly evaluated and published in a more complete report. The District has found instances in the past of a lack of information sharing particularly from the larger WWTPs. There could very well be things smaller plants could learn and apply, having consistent collection of such data would be easier to that end.

15. *Do reviewers have feedback on the proposed timeframes for this evaluation?*

In general, the District operates on a 10-year window for future capital improvement projects (CIP) and within the framework of the Growth Management Act Comprehensive Plan. Because of this mindset it is easier to plan with longer notice periods and very difficult with shorter periods. Thus, starting the Regional Collaboration for Technology Exploration discussions and planning in year 3 would allow us more time for needed planning and future implementation.

16. *Is there interest in folding this type of treatment technology information sharing into an existing stakeholder process?*

As stated, The District has found instances in the past of a lack of information sharing particularly from the larger WWTPs. In addition, stakeholder committees and advisory committees are often limited to only a small percentage of the overall committee comprised of individuals with current WWTP experience or vested interest in what we feel is often the dissenting opinion.

17. *Do reviewers have suggestions or ideas for other Tier 3 actions that Ecology should consider? Should plants be able to identify different Tier 3 actions during the permit term provided Ecology pre-approval?*

No comment to the first question. Yes, additional flexibility may be warranted during the permit term for solutions that may not be identified yet.

Overall, it is the District's desire that Ecology please consider that costs of treating wastewater have and are expected to increase in years to come. WWTP point-sources are easy targets for regulation, but at what cost? Each increase in maintenance and operations and capital improvements comes with corresponding pressure applied on ratepayers, especially the underprivileged. These increases need to be carefully weighed so that our receiving waters are healthy and our costs are appropriate.

Thank you for this opportunity to comment on the Puget Sound Nutrient General Permit Preliminary Draft.

Sincerely,

Mariah Low

Mariah Low
Interim General Manager
Lake Stevens Sewer District

Attached: Gray & Osborne, Inc. Technical Memorandum

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

TO:	MARIAH LOW, GENERAL MANAGER JOHNATHAN DIX, ASSISTANT GENERAL MANAGER JAMES HEITZMAN, WASTEWATER TREATMENT PLANT SUPERVISOR JEFF BAISCH, SENIOR WASTEWATER TREATMENT PLANT OPERATOR
FROM:	JAY SWIFT, P.E. KOTA NISHIGUCHI, E.I.T.
DATE:	MARCH 12, 2021
SUBJECT:	TOTAL INORGANIC NITROGEN ACTION LEVEL EVALUATION, PRELIMINARY DRAFT PUGET SOUND NUTRIENT GENERAL PERMIT LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON G&O #20408.07

The following memorandum notes findings from investigation into the total inorganic nitrogen (TIN) action level determination provided in the Preliminary Draft Puget Sound Nutrient General Permit (Draft Permit) dated January 2021. These analyses were done to assist with the evaluation of wastewater treatment capital and operating improvements in the Lake Stevens Sewer District General Sewer/Wastewater Facility Plan (Gray & Osborne, in progress), as well as to assist the District with the development of review comments to be submitted to the Washington State Department of Ecology (Ecology) regarding the Draft Permit.

SUMMARY

The Draft Permit indicates that the calculated baseline action level (AL_0) is meant to represent predicted 99th percentile plant effluent TIN loads based on historical observations. Calculation of AL_0 assumes that if a facility behaves over the course of the permit cycle in a manner similar to its historical record, it can be assumed that "there is only a 1 percent chance of exceeding AL_0 by chance in any year." The second action level (AL_1) is calculated as a 5 percent increase of AL_0.

District staff routinely analyze effluent ammonia and nitrate concentrations in house and record this data on their plant process data sheets, but do not submit this nitrate data on

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their discharge monitoring reports (DMRs). Effluent nitrate/nitrite concentrations are also analyzed once a month at the Everett Wastewater Treatment Plant (WWTP) laboratory and this is the data that is reported on the District's DMRs.

Calculations of annual effluent TIN load were separately determined using the more complete WWTP process data and show that annual loading has surpassed the proposed action levels for 3 of the past 4 years, as shown in Table 1. This would appear to conflict with the intent of the action level determination (1 percent chance of exceedance) as described in the Draft Permit.

TABLE 1

Historical Effluent TIN Loads and Proposed Action Levels

Year	**Annual Effluent TIN Load (lb/yr) (1)**
2017	136,891
2018	115,320
2019	129,513
2020(2)	132,960
Draft Permit Proposed Action Limit	**Annual Effluent TIN Load (lb/yr)**
AL_0	122,000
AL_1	128,100

(1) Annual averages of TIN loadings calculated from process data (507 data points) are summarized in Table 1. Annual averages for TIN loadings calculated from DMR data (109 data points) ranged from 106,500 to 129,100 lb/yr.

(2) December 2020 represented by one datum for nitrate, available from DMR.

Based on a review of the data and calculations, data input assumptions appear to have perhaps not fully represented the historical distribution of loadings, which resulted in a lower proposed action level than appropriate. Two alternative approaches to data input, which rely on actual measurements and minimize assumptions in the data input, are shown herein and resulted in a higher range of action levels (AL_0 between 134,000 and 145,000 pounds per year [lb/yr]).

DATA INPUT AND CALCULATION FOR DRAFT PERMIT PROPOSED ACTION LEVEL

The data used to calculate the AL_0 in the Draft Permit uses data available through DMRs ranging from January 2016 to November 2020. The action level calculator shared by Ecology requires inputs of daily effluent TIN load and the associated date. In general, all other data provided in the input file appears to be unused and is organized in the calculator to provide additional context.

Apparent Assumptions Made for Draft Permit Calculation

The data input file used for the Draft Permit action level calculation shows that input loads were calculated with ***daily*** flows and ***daily*** effluent ammonia concentrations; however, these were used in conjunction with ***monthly*** reported effluent nitrate (single-day composite measurement per month reported via DMR) illustrated as follows:

$$\begin{aligned} Daily\ TIN\ Load &= Daily\ TIN\ Concentration * Daily\ Flow * 8.34 \\ &= (Daily\ Ammonia\ Concentration + Monthly\ Reported\ Nitrate) * Daily\ Flow * 8.34 \end{aligned}$$

With concentrations noted in milligrams per liter (mg/L) and flows in million gallons per day (MGD).

This approach to providing daily TIN load inputs implies an assumption that daily variations in flow and ammonia concentrations have greater impact on effluent TIN than variations in effluent nitrate. In the Draft Permit calculation, each monthly reported effluent nitrate concentration is used as an average representative value for the entire month. This assumption appears to have perhaps not fully represented the historical distribution of loadings. Based on plant data, it is rare for effluent ammonia concentrations to be greater than effluent nitrate concentrations. Additionally, nitrate concentrations are typically an order of magnitude greater than ammonia concentrations; starting from 2017, the average ammonia concentration was 1.22 mg/L while nitrate was 14.5 mg/L, meaning that effluent TIN is primarily comprised of nitrate. Consequently, variations in effluent nitrate loadings tend to be primarily responsible for variations in effluent TIN. The Draft Permit's calculation does not accurately reflect that daily variations in nitrate values have significant impact on daily TIN loads. (Note: Nitrite concentrations measured in Lake Stevens effluent have been less than 0.1 percent of nitrate concentrations, so nitrate concentrations are assumed to equal nitrate plus nitrite in this data.)

The above approach to estimating daily TIN load provides a set of data inputs that maximizes the use of available ammonia measurements despite the fact that effluent TIN is comprised primarily of nitrate, for which fewer data points are available in the DMR

data set. The apparent assumption is that a larger data set with approximated TIN values is more representative than a smaller data set, consisting of more accurate representations of the distribution of historical TIN loadings. Bootstrapping used to determine AL_0 randomly resamples data points from the data input to create multiple simulated data sets, all consisting of a variety of combinations of data points from the original data input. Individual data points from the original data input are being used multiple times to holistically represent the data and create simulated observations. Because of the resampling of data used in bootstrapping, the benefit of bootstrapping is dependent on the accuracy of the original data input, not only the mean values but also the variability in the data. The Draft Permit data input had introduced approximated values, whose inaccuracies likely propagated through the simulated observations, and reduced variability and narrowed confidence intervals.

Alternative Approaches to Data Input

Two alternative approaches are presented to data input: (1) maximize the use of plant process data, and (2) refine usage of DMR data.

<u>Alternative 1 – Maximize Use of Plant Process Data</u>

Based on a review of available data (DMRs and plant process data), the following changes were applied as an alternative approach to data input:

- Whenever available in plant process data, flow, ammonia, and nitrate concentrations measured for the same date were used to calculate daily effluent TIN loads.

- DMR nitrate data were only used when the lack of plant process data would result in missing a month of TIN load. The DMR nitrate data points were used in conjunction with the flow and ammonia concentration of the date for which nitrate was reported; this limits the quantity of approximated TIN loads in the data input. Notably, much of the input data for 2016 consists of this approach due to the limited nitrate data in 2016.

- Lastly, as a note, the Draft Permit calculation for AL_0 included data input for November 2016 for which the reported nitrate concentration was 1.3 mg/L; plant process data shows that nitrate ranged from 12.6 to 21.3 mg/L during this period. This misinput of data likely had some influence on the Draft Permit AL_0 determinations. As discussed above, November 2016 inputs have been replaced with TIN loads calculated with available plant process data.

Due to the inclusion of plant process data, the data input described above consists of 597 data points, compared to 476 data points used for the Draft Permit action level determination. For this alternative approach for data input, a large majority of data points consist of TIN loads calculated from plant process data that accurately represent flow, ammonia, and nitrate. Therefore, this alternative approach is believed to increase the quantity and quality of input data.

As shown on Figure 1, with these revised assumptions, Ecology's Action Level Calculator returns an AL_0 of 145,000 lb/yr. In turn, the AL_1 would be 152,250 lb/yr. Based on Figure 1, the action level appears plausible according to Ecology's intent (1 percent exceedance chance) for the action level; unlike the Draft Permit's proposed AL_0, the alternative AL_0 has not been exceeded by the WWTP multiple times in recent history.

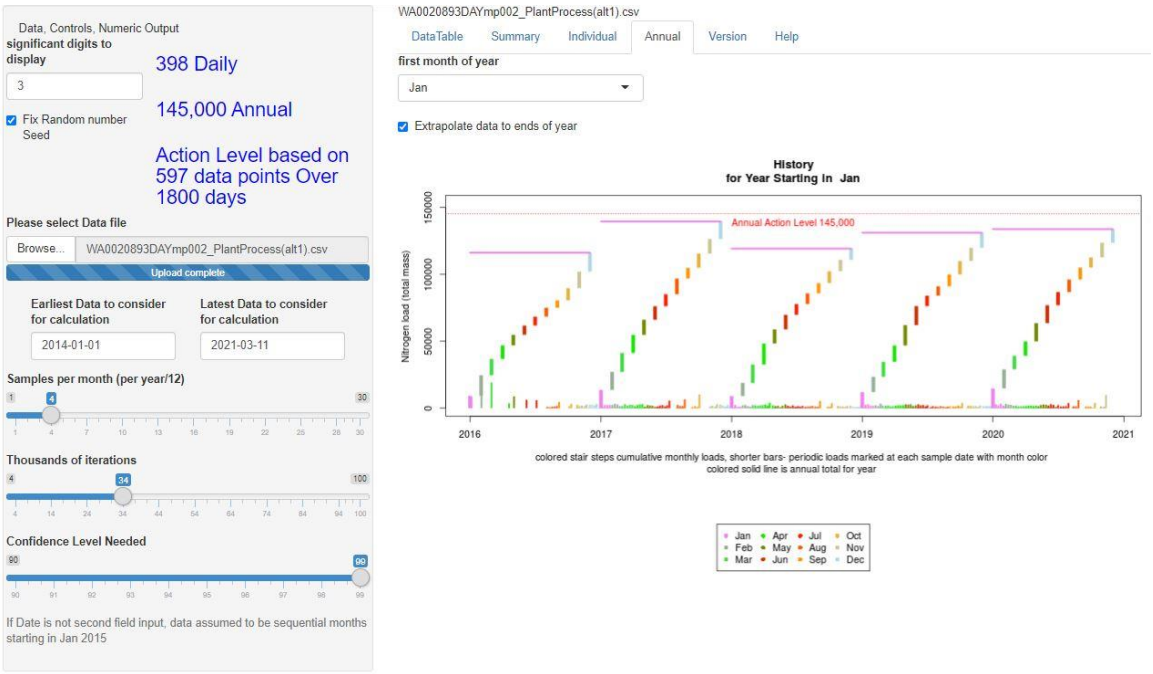


FIGURE 1

Revised Action Level (AL_0) Calculation, Alternative 1 – Screen Capture

Alternative 2 – Refine Usage of DMR Data

Another approach to data input consists of continuing the use of reported nitrate data but removing the data points that approximate TIN concentration based on assumptions of constant nitrate levels throughout the month. In turn, data used in the original Draft Permit calculation would be used without the assumptions that are believed to have perhaps misrepresented the historical distribution of TIN loadings. The following changes were applied to the original data input:

- Whenever available in DMR data, flow, ammonia, and nitrate concentrations measured for the same date were used to calculate daily effluent TIN loads.

- For any month of DMR data that did not allow for a calculation of daily effluent TIN (e.g., no ammonia measurement for corresponding nitrate measurement), plant process data was used to represent TIN loads for the month. Here, the use of plant process data followed its use for the first alternative approach. This method was applicable for data for August 2016 and August 2018.

- For the previously discussed reasons, November 2016 inputs have been replaced with TIN loads calculated with available plant process data.

The TIN action level calculation resulting from the revisions above is shown on Figure 2. The calculator returns an AL_0 of 134,000 lb/yr. Based on this value, the AL_1 would be 140,700 lb/yr.

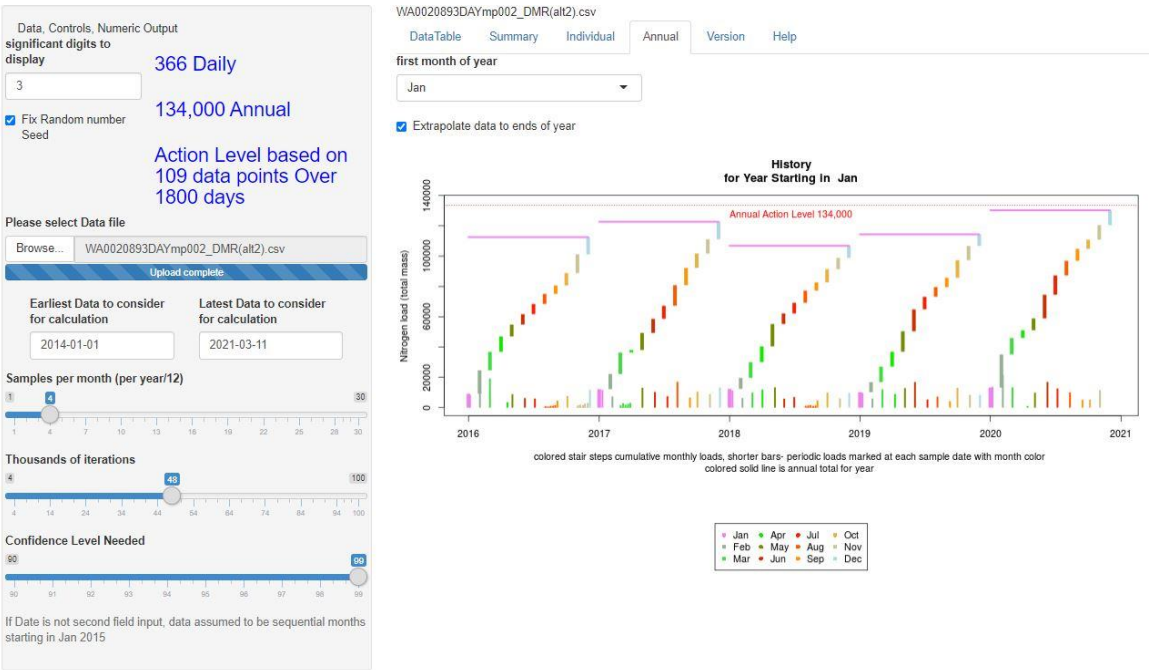


FIGURE 2

Revised Action Level (AL_0) Calculation, Alternative 2 – Screen Capture

Notably, the historical TIN loads calculated from plant process data, shown in Table 1, suggest that the AL_0 of 134,000 lb/yr has been surpassed at least once in recent history. Conversely, the historical TIN loads calculated from DMR data, shown on Figure 2, suggest that the AL_0 has not been exceeded since 2016. Therefore, there is a discrepancy between historical observations made from plant process data and DMR data. However, this discrepancy derived from the different data sets is considered slight. Either data set can be used to calculate a revised AL_0 that better represents the historical distribution of TIN loadings observations than the AL_0 proposed in the Draft Permit. However, Alternative 1, with five times the data points, provides a larger, more robust data set for the action limit calculation.

ATTACHMENT A

DRAFT PERMIT ACTION LEVEL

TIN AL_0 Calculator

Intro

The action level is displayed on the left side once the data is loaded. Action level is recalulated as controls are adjusted

On the right side, you can find a plot of monthly loads and annual loads compared to the action level

File must be space or tab delimited text with column for load first, and ...

if desired second column with date in 'YYYY-MM-DD' or 'MM/DD/YYYY' format, will allow distinguishing data by month.

See "Help" tab for more detailed instructions

Define a load to determine fraction of estimates that exceed the load

Defined average daily load

335

Fraction of estimates exceeding 335 = 1%

Data, Controls, Numeric Output

significant digits to display

3

335 Daily

122,000 Annual

Action Level based on 476 data points Over 1760 days

☑ Fix Random number Seed

Please select Data file

Browse... WA0020893DAYmp002.csv

Upload complete

Earliest Data to consider for calculation

2014-01-01

Latest Data to consider for calculation

2021-03-04

Samples per month (per year/12)

1 4 30

Thousands of iterations

4 58 100

Confidence Level Needed

90 99

If Date is not second field input, data assumed to be sequential months starting in Jan 2015

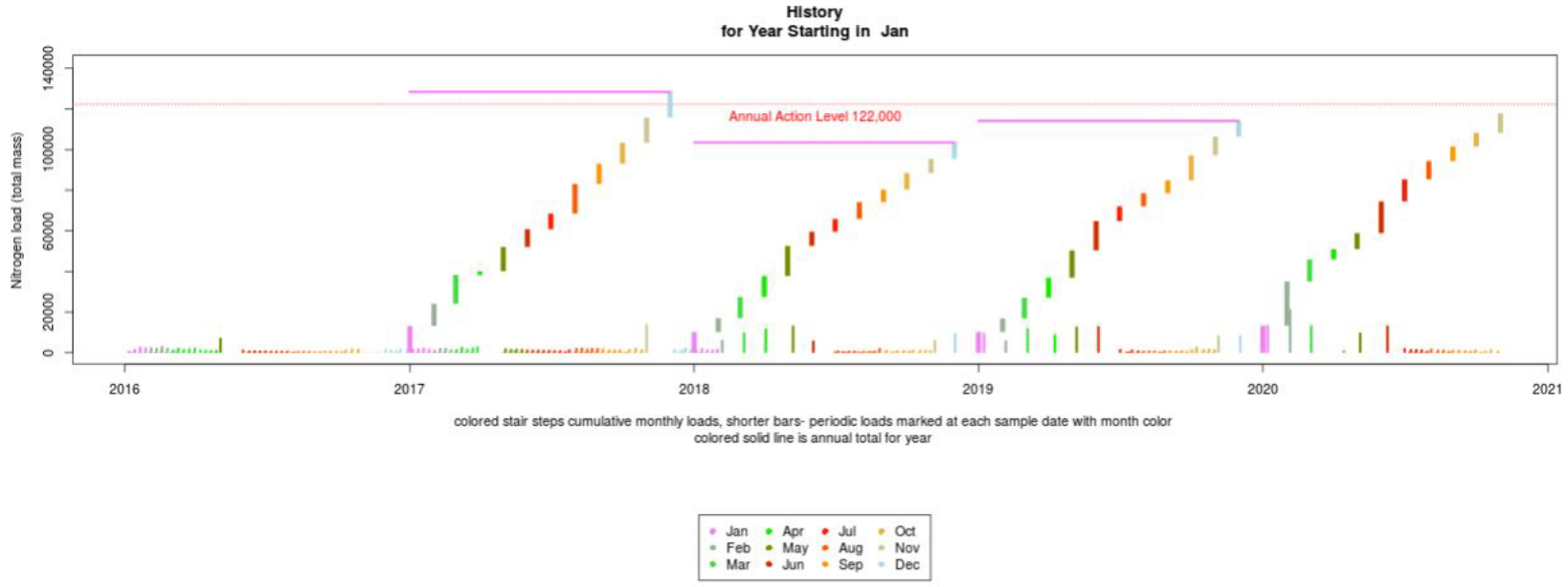
WA0020893DAYmp002.csv

DataTable | Summary | Individual | Annual | Version | Help

first month of year

Jan

☐ Extrapolate data to ends of year



load	POS	Q2	Qave	AMM	NIT	Ammonia	Nitrate...Nitrite
297.7915	1/5/2016	2.511	3.12294	0.02	14.2	0.02	14.2
294.3219	1/6/2016	2.48	3.12294	0.03	14.2	0.03	NA
285.1466	1/7/2016	2.401	3.12294	0.04	14.2	0.04	NA
291.3959	1/11/2016	2.372	3.12294	0.53	14.2	0.53	NA
375.6498	1/13/2016	3.141	3.12294	0.14	14.2	0.14	NA
347.3376	1/14/2016	2.814	3.12294	0.6	14.2	0.6	NA
367.5655	1/19/2016	3.082	3.12294	0.1	14.2	0.1	NA
360.1724	1/20/2016	3.037	3.12294	0.02	14.2	0.02	NA
577.6618	1/21/2016	4.81	3.12294	0.2	14.2	0.2	NA
389.5839	1/26/2016	3.285	3.12294	0.02	14.2	0.02	NA
403.9339	1/27/2016	3.406	3.12294	0.02	14.2	0.02	NA
548.1452	1/28/2016	4.622	3.12294	0.02	14.2	0.02	NA
540.1278	2/2/2016	2.848	2.97866	0.04	22.7	0.04	22.7
539.0345	2/3/2016	2.836	2.97866	0.09	22.7	0.09	NA
529.5504	2/4/2016	2.791	2.97866	0.05	22.7	0.05	NA
487.312	2/9/2016	2.565	2.97866	0.08	22.7	0.08	NA
482.7524	2/10/2016	2.541	2.97866	0.08	22.7	0.08	NA
492.0356	2/11/2016	2.591	2.97866	0.07	22.7	0.07	NA
731.4113	2/16/2016	3.86	2.97866	0.02	22.7	0.02	NA
725.3569	2/17/2016	3.823	2.97866	0.05	22.7	0.05	NA
651.4532	2/18/2016	3.435	2.97866	0.04	22.7	0.04	NA
511.0405	2/23/2016	2.697	2.97866	0.02	22.7	0.02	NA
490.7656	2/24/2016	2.59	2.97866	0.02	22.7	0.02	NA
482.2888	2/25/2016	2.533	2.97866	0.13	22.7	0.13	NA
392.5671	3/1/2016	2.92	3.07742	0.02	16.1	0.02	16.1
379.6608	3/2/2016	2.824	3.07742	0.02	16.1	0.02	NA
374.4148	3/3/2016	2.761	3.07742	0.16	16.1	0.16	NA
446.8127	3/7/2016	3.303	3.07742	0.12	16.1	0.12	NA
511.4128	3/9/2016	3.804	3.07742	0.02	16.1	0.02	NA
493.7867	3/10/2016	3.648	3.07742	0.13	16.1	0.13	NA
424.0865	3/15/2016	3.135	3.07742	0.12	16.1	0.12	NA
398.7514	3/16/2016	2.966	3.07742	0.02	16.1	0.02	NA
376.7031	3/17/2016	2.802	3.07742	0.02	16.1	0.02	NA
362.1391	3/22/2016	2.692	3.07742	0.03	16.1	0.03	NA
387.7273	3/23/2016	2.884	3.07742	0.02	16.1	0.02	NA
443.9235	3/24/2016	3.302	3.07742	0.02	16.1	0.02	NA
401.7091	3/29/2016	2.988	3.07742	0.02	16.1	0.02	NA
377.0001	3/30/2016	2.799	3.07742	0.05	16.1	0.05	NA
363.3935	3/31/2016	2.703	3.07742	0.02	16.1	0.02	NA
281.6134	4/7/2016	2.492	2.43637	0.15	13.4	0.15	NA
272.5111	4/12/2016	2.433	2.43637	0.03	13.4	0.03	NA
264.1945	4/13/2016	2.35	2.43637	0.08	13.4	0.08	NA
264.8093	4/14/2016	2.366	2.43637	0.02	13.4	0.02	NA
256.8628	4/19/2016	2.295	2.43637	0.02	13.4	0.02	13.4

260.5563	4/20/2016	2.328	2.43637	0.02	13.4	0.02	NA	
245.7825	4/21/2016	2.196	2.43637	0.02	13.4	0.02	NA	
278.8954	4/26/2016	2.49	2.43637	0.03	13.4	0.03	NA	
269.8459	4/27/2016	2.411	2.43637	0.02	13.4	0.02	NA	
271.9724	4/28/2016	2.43	2.43637	0.02	13.4	0.02	NA	
252.4835	5/3/2016	2.29	2.22839	0.02	13.2	0.02		13.2
239.4848	6/1/2016	2.192	2.1628	0.4	12.7	0.4	NA	
224.8998	6/7/2016	2.12	2.1628	0.02	12.7	0.02		12.7
223.1259	6/8/2016	2.082	2.1628	0.15	12.7	0.15	NA	
216.2008	6/9/2016	2.038	2.1628	0.02	12.7	0.02	NA	
236.463	6/14/2016	2.229	2.1628	0.02	12.7	0.02	NA	
236.8874	6/15/2016	2.233	2.1628	0.02	12.7	0.02	NA	
227.658	6/16/2016	2.146	2.1628	0.02	12.7	0.02	NA	
229.1432	6/21/2016	2.16	2.1628	0.02	12.7	0.02	NA	
226.7032	6/22/2016	2.137	2.1628	0.02	12.7	0.02	NA	
222.7781	6/23/2016	2.1	2.1628	0.02	12.7	0.02	NA	
218.959	6/28/2016	2.064	2.1628	0.02	12.7	0.02	NA	
223.3085	6/29/2016	2.105	2.1628	0.02	12.7	0.02	NA	
216.9434	6/30/2016	2.045	2.1628	0.02	12.7	0.02	NA	
214.6773	7/5/2016	2.254	2.09394	0.02	11.4	0.02		11.4
203.8196	7/6/2016	2.14	2.09394	0.02	11.4	0.02	NA	
194.7715	7/7/2016	2.045	2.09394	0.02	11.4	0.02	NA	
195.0573	7/12/2016	2.048	2.09394	0.02	11.4	0.02	NA	
194.0096	7/13/2016	2.037	2.09394	0.02	11.4	0.02	NA	
189.5332	7/14/2016	1.99	2.09394	0.02	11.4	0.02	NA	
202.391	7/19/2016	2.125	2.09394	0.02	11.4	0.02	NA	
198.867	7/20/2016	2.088	2.09394	0.02	11.4	0.02	NA	
187.8188	7/21/2016	1.972	2.09394	0.02	11.4	0.02	NA	
187.3426	7/26/2016	1.967	2.09394	0.02	11.4	0.02	NA	
191.0571	7/27/2016	2.006	2.09394	0.02	11.4	0.02	NA	
200.2956	7/28/2016	2.103	2.09394	0.02	11.4	0.02	NA	
174.3754	8/2/2016	2.026	2.05555	0.02	10.3	0.02	NA	
179.1122	8/3/2016	2.073	2.05555	0.06	10.3	0.06	NA	
178.0763	8/4/2016	2.069	2.05555	0.02	10.3	0.02	NA	
176.0968	8/6/2016	2.046	2.05555	0.02	10.3	NA		10.3
185.4366	8/9/2016	2.078	2.05555	0.4	10.3	0.4	NA	
175.317	8/10/2016	2.033	2.05555	0.04	10.3	0.04	NA	
170.3302	8/11/2016	1.979	2.05555	0.02	10.3	0.02	NA	
183.1544	8/16/2016	2.128	2.05555	0.02	10.3	0.02	NA	
178.1444	8/17/2016	2.046	2.05555	0.14	10.3	0.14	NA	
178.708	8/18/2016	2.033	2.05555	0.24	10.3	0.24	NA	
174.8057	8/23/2016	2.031	2.05555	0.02	10.3	0.02	NA	
175.9228	8/24/2016	2.042	2.05555	0.03	10.3	0.03	NA	
169.5555	8/25/2016	1.97	2.05555	0.02	10.3	0.02	NA	
179.0231	8/30/2016	2.08	2.05555	0.02	10.3	0.02	NA	

176.9154	8/31/2016	2.028	2.05555	0.16	10.3	0.16	NA	
151.2089	9/1/2016	1.988	2.2469	0.08	9.04	0.08	NA	
166.9885	9/6/2016	2.21	2.2469	0.02	9.04	0.02		9.04
180.2144	9/7/2016	2.359	2.2469	0.12	9.04	0.12	NA	
182.3363	9/8/2016	2.361	2.2469	0.22	9.04	0.22	NA	
180.5747	9/12/2016	2.356	2.2469	0.15	9.04	0.15	NA	
186.1528	9/13/2016	2.352	2.2469	0.45	9.04	0.45	NA	
183.5477	9/14/2016	2.283	2.2469	0.6	9.04	0.6	NA	
176.9937	9/19/2016	2.241	2.2469	0.43	9.04	0.43	NA	
167.686	9/20/2016	2.176	2.2469	0.2	9.04	0.2	NA	
166.7093	9/21/2016	2.154	2.2469	0.24	9.04	0.24	NA	
164.0828	9/27/2016	2.093	2.2469	0.36	9.04	0.36	NA	
175.3558	9/28/2016	2.308	2.2469	0.07	9.04	0.07	NA	
174.0944	9/29/2016	2.247	2.2469	0.25	9.04	0.25	NA	
274.7339	10/4/2016	2.401	2.80587	0.02	13.7	0.02		13.7
275.8704	10/5/2016	2.378	2.80587	0.21	13.7	0.21	NA	
267.1325	10/6/2016	2.316	2.80587	0.13	13.7	0.13	NA	
298.7923	10/9/2016	2.598	2.80587	0.09	13.7	0.09	NA	
276.5647	10/10/2016	2.417	2.80587	0.02	13.7	0.02	NA	
248.6154	10/11/2016	2.168	2.80587	0.05	13.7	0.05	NA	
362.0962	10/17/2016	3.153	2.80587	0.07	13.7	0.07	NA	
342.5342	10/18/2016	2.987	2.80587	0.05	13.7	0.05	NA	
347.5598	10/19/2016	2.964	2.80587	0.36	13.7	0.36	NA	
303.6834	10/25/2016	2.654	2.80587	0.02	13.7	0.02	NA	
392.176	10/26/2016	3.335	2.80587	0.4	13.7	0.4	NA	
367.6469	10/27/2016	3.213	2.80587	0.02	13.7	0.02	NA	
39.71975	11/1/2016	3.608	3.4292	0.02	1.3	0.02	NA	
33.92912	11/3/2016	3.082	3.4292	0.02	1.3	0.02	NA	
32.66311	11/7/2016	2.967	3.4292	0.02	1.3	0.02	NA	
30.57144	11/8/2016	2.777	3.4292	0.02	1.3	0.02		1.3
31.62828	11/9/2016	2.873	3.4292	0.02	1.3	0.02	NA	
47.74517	11/15/2016	4.337	3.4292	0.02	1.3	0.02	NA	
40.51238	11/16/2016	3.68	3.4292	0.02	1.3	0.02	NA	
36.2313	11/17/2016	3.242	3.4292	0.04	1.3	0.04	NA	
39.02069	11/20/2016	3.366	3.4292	0.09	1.3	0.09	NA	
34.24271	11/21/2016	3.019	3.4292	0.06	1.3	0.06	NA	
35.84999	11/22/2016	3.232	3.4292	0.03	1.3	0.03	NA	
42.33984	11/29/2016	3.846	3.4292	0.02	1.3	0.02	NA	
43.09945	11/30/2016	3.915	3.4292	0.02	1.3	0.02	NA	
378.5476	12/1/2016	3.745	3.18406	0.02	12.1	0.02	NA	
337.9131	12/6/2016	3.343	3.18406	0.02	12.1	0.02		12.1
321.9718	12/7/2016	3.167	3.18406	0.09	12.1	0.09	NA	
310.5854	12/8/2016	3.055	3.18406	0.09	12.1	0.09	NA	
312.6429	12/13/2016	3.093	3.18406	0.02	12.1	0.02	NA	
299.4013	12/14/2016	2.962	3.18406	0.02	12.1	0.02	NA	

295.7751	12/15/2016	2.888	3.18406	0.18	12.1	0.18	NA
290.6073	12/19/2016	2.875	3.18406	0.02	12.1	0.02	NA
292.9602	12/20/2016	2.884	3.18406	0.08	12.1	0.08	NA
315.4434	12/27/2016	3.113	3.18406	0.05	12.1	0.05	NA
301.8422	12/28/2016	2.969	3.18406	0.09	12.1	0.09	NA
321.7886	12/29/2016	3.142	3.18406	0.18	12.1	0.18	NA
448.475	1/3/2017	2.913	2.83858	0.86	17.6	0.86	NA
411.1324	1/4/2017	2.793	2.83858	0.05	17.6	0.05	NA
402.2043	1/5/2017	2.737	2.83858	0.02	17.6	0.02	NA
417.5748	1/10/2017	2.742	2.83858	0.66	17.6	0.66	17.6
416.1667	1/11/2017	2.824	2.83858	0.07	17.6	0.07	NA
398.7138	1/12/2017	2.611	2.83858	0.71	17.6	0.71	NA
441.4402	1/17/2017	3.004	2.83858	0.02	17.6	0.02	NA
580.3159	1/18/2017	3.717	2.83858	1.12	17.6	1.12	NA
513.1494	1/19/2017	3.49	2.83858	0.03	17.6	0.03	NA
397.9531	1/24/2017	2.705	2.83858	0.04	17.6	0.04	NA
421.4529	1/25/2017	2.736	2.83858	0.87	17.6	0.87	NA
400.5879	1/26/2017	2.726	2.83858	0.02	17.6	0.02	NA
376.9509	1/31/2017	2.555	2.83858	0.09	17.6	0.09	NA
294.0252	2/1/2017	2.551	3.23468	0.02	13.8	0.02	NA
298.1821	2/2/2017	2.509	3.23468	0.45	13.8	0.45	NA
338.3998	2/7/2017	2.936	3.23468	0.02	13.8	0.02	13.8
375.5132	2/8/2017	3.258	3.23468	0.02	13.8	0.02	NA
468.7498	2/9/2017	3.989	3.23468	0.29	13.8	0.29	NA
374.3736	2/14/2017	3.062	3.23468	0.86	13.8	0.86	NA
477.6254	2/15/2017	4.129	3.23468	0.07	13.8	0.07	NA
468.0341	2/16/2017	4.02	3.23468	0.16	13.8	0.16	NA
383.2787	2/21/2017	3.311	3.23468	0.08	13.8	0.08	NA
376.2047	2/22/2017	3.264	3.23468	0.02	13.8	0.02	NA
355.1124	2/23/2017	3.081	3.23468	0.02	13.8	0.02	NA
375.3706	2/28/2017	3.087	3.23468	0.78	13.8	0.78	NA
473.7123	3/1/2017	3.092	3.55358	0.47	17.9	0.47	17.9
340.1004	3/2/2017	3.014	3.55358	0.03	13.5	0.03	13.5
480.41	3/7/2017	3.702	3.55358	0.46	15.1	0.46	15.1
530.6627	3/8/2017	3.498	3.55358	0.39	17.8	0.39	17.8
588.8736	3/9/2017	3.586	3.55358	0.19	19.5	0.19	19.5
348.3535	3/14/2017	3.825	3.55358	0.02	10.9	0.02	10.9
414.1466	3/15/2017	4.379	3.55358	0.04	11.3	0.04	11.3
387.1395	3/16/2017	3.83	3.55358	0.02	12.1	0.02	12.1
440.5084	3/21/2017	3.375	3.55358	0.15	15.5	0.15	15.5
469.8085	3/22/2017	3.188	3.55358	0.77	16.9	0.77	16.9
523.2519	3/23/2017	3.077	3.55358	0.49	19.9	0.49	19.9
286.2185	3/28/2017	3.358	3.55358	0.02	10.2	0.02	10.2
529.6879	3/29/2017	4.002	3.55358	0.17	15.7	0.17	15.7
1.299789	4/4/2017	3.117	3.26913	0.04	0.01	0.04	0.01

0.8129	4/5/2017	3.249	3.26913	0.02	0.01	0.02	NA
0.786379	4/6/2017	3.143	3.26913	0.02	0.01	0.02	NA
3.848076	4/11/2017	3.076	3.26913	0.14	0.01	0.14	NA
0.941503	4/12/2017	3.763	3.26913	0.02	0.01	0.02	NA
0.940001	4/13/2017	3.757	3.26913	0.02	0.01	0.02	NA
0.715072	4/18/2017	2.858	3.26913	0.02	0.01	0.02	NA
0.746847	4/19/2017	2.985	3.26913	0.02	0.01	0.02	NA
10.30424	4/20/2017	3.861	3.26913	0.31	0.01	0.31	NA
0.773118	4/25/2017	3.09	3.26913	0.02	0.01	0.02	NA
0.844675	4/26/2017	3.376	3.26913	0.02	0.01	0.02	NA
30.09147	4/27/2017	3.193	3.26913	1.12	0.01	1.12	NA
375.9532	5/2/2017	2.828	2.92835	0.04	15.9	0.04	15.9
391.2814	5/3/2017	2.947	2.92835	0.02	15.9	0.02	NA
439.6107	5/4/2017	3.311	2.92835	0.02	15.9	0.02	NA
380.9252	5/9/2017	2.869	2.92835	0.02	15.9	0.02	NA
411.4622	5/10/2017	2.8	2.92835	1.72	15.9	1.72	NA
378.9995	5/11/2017	2.842	2.92835	0.09	15.9	0.09	NA
481.5669	5/16/2017	3.627	2.92835	0.02	15.9	0.02	NA
403.5077	5/18/2017	3.022	2.92835	0.11	15.9	0.11	NA
387.0934	5/23/2017	2.844	2.92835	0.42	15.9	0.42	NA
372.2919	5/24/2017	2.783	2.92835	0.14	15.9	0.14	NA
377.4731	5/25/2017	2.843	2.92835	0.02	15.9	0.02	NA
349.5276	5/30/2017	2.621	2.92835	0.09	15.9	0.09	NA
343.3118	5/31/2017	2.576	2.92835	0.08	15.9	0.08	NA
308.5566	6/1/2017	2.58	2.41167	0.04	14.3	0.04	NA
296.5849	6/6/2017	2.473	2.41167	0.08	14.3	0.08	14.3
291.4396	6/7/2017	2.42	2.41167	0.14	14.3	0.14	NA
301.6771	6/8/2017	2.526	2.41167	0.02	14.3	0.02	NA
290.4508	6/13/2017	2.432	2.41167	0.02	14.3	0.02	NA
305.26	6/14/2017	2.556	2.41167	0.02	14.3	0.02	NA
289.376	6/15/2017	2.423	2.41167	0.02	14.3	0.02	NA
280.9626	6/20/2017	2.346	2.41167	0.06	14.3	0.06	NA
290.0343	6/21/2017	2.41	2.41167	0.13	14.3	0.13	NA
275.1171	6/22/2017	2.302	2.41167	0.03	14.3	0.03	NA
276.9554	6/27/2017	2.319	2.41167	0.02	14.3	0.02	NA
275.2834	6/28/2017	2.305	2.41167	0.02	14.3	0.02	NA
276.3582	6/29/2017	2.314	2.41167	0.02	14.3	0.02	NA
252.5989	7/4/2017	2.298	2.21252	0.08	13.1	0.08	NA
262.9352	7/5/2017	2.325	2.21252	0.46	13.1	0.46	NA
257.5309	7/6/2017	2.35	2.21252	0.04	13.1	0.04	NA
268.4092	7/11/2017	2.453	2.21252	0.02	13.1	0.02	13.1
239.5221	7/12/2017	2.189	2.21252	0.02	13.1	0.02	NA
241.4917	7/13/2017	2.207	2.21252	0.02	13.1	0.02	NA
242.0043	7/18/2017	2.21	2.21252	0.03	13.1	0.03	NA
252.8781	7/19/2017	2.172	2.21252	0.86	13.1	0.86	NA

228.5801	7/20/2017	2.089	2.21252	0.02	13.1	0.02	NA	
251.3819	7/23/2017	2.268	2.21252	0.19	13.1	0.19	NA	
264.7983	7/24/2017	2.42	2.21252	0.02	13.1	0.02	NA	
232.3417	7/25/2017	2.032	2.21252	0.61	13.1	0.61	NA	
466.1551	8/1/2017	2.11	2.08839	0.19	26.3	0.19	NA	
459.8192	8/2/2017	2.09	2.08839	0.08	26.3	0.08	NA	
470.2826	8/3/2017	2.08	2.08839	0.81	26.3	0.81	NA	
488.1502	8/8/2017	2.08	2.08839	1.84	26.3	1.84		26.3
454.2631	8/9/2017	2.04	2.08839	0.4	26.3	0.4	NA	
489.5046	8/10/2017	2.23	2.08839	0.02	26.3	0.02	NA	
481.6267	8/15/2017	2.15	2.08839	0.56	26.3	0.56	NA	
456.5783	8/16/2017	2.08	2.08839	0.02	26.3	0.02	NA	
467.1401	8/17/2017	2.09	2.08839	0.5	26.3	0.5	NA	
456.5783	8/21/2017	2.08	2.08839	0.02	26.3	0.02	NA	
463.1636	8/22/2017	2.11	2.08839	0.02	26.3	0.02	NA	
468.2668	8/23/2017	2.11	2.08839	0.31	26.3	0.31	NA	
470.4627	8/28/2017	2.14	2.08839	0.06	26.3	0.06	NA	
459.5757	8/29/2017	2.06	2.08839	0.45	26.3	0.45	NA	
452.7035	8/30/2017	2.06	2.08839	0.05	26.3	0.05	NA	
353.6282	9/4/2017	2.253	2.09257	0.42	18.4	0.42	NA	
331.3906	9/5/2017	2.156	2.09257	0.03	18.4	0.03	NA	
324.4507	9/6/2017	2.104	2.09257	0.09	18.4	0.09	NA	
317.5288	9/12/2017	2.058	2.09257	0.1	18.4	0.1		18.4
331.9789	9/13/2017	2.161	2.09257	0.02	18.4	0.02	NA	
310.0108	9/14/2017	2.018	2.09257	0.02	18.4	0.02	NA	
330.1354	9/19/2017	2.149	2.09257	0.02	18.4	0.02	NA	
316.9238	9/20/2017	2.063	2.09257	0.02	18.4	0.02	NA	
319.4974	9/21/2017	2.073	2.09257	0.08	18.4	0.08	NA	
316.6166	9/26/2017	2.061	2.09257	0.02	18.4	0.02	NA	
316.463	9/27/2017	2.06	2.09257	0.02	18.4	0.02	NA	
309.0891	9/28/2017	2.012	2.09257	0.02	18.4	0.02	NA	
303.6978	10/3/2017	2.055	2.291	0.02	17.7	0.02		17.7
301.6288	10/4/2017	2.041	2.291	0.02	17.7	0.02	NA	
302.9687	10/5/2017	2.042	2.291	0.09	17.7	0.09	NA	
293.3528	10/6/2017	1.985	2.291	0.02	17.7	0.02	NA	
340.2006	10/8/2017	2.302	2.291	0.02	17.7	0.02	NA	
315.6683	10/9/2017	2.136	2.291	0.02	17.7	0.02	NA	
307.7393	10/10/2017	2.08	2.291	0.04	17.7	0.04	NA	
313.3615	10/16/2017	2.118	2.291	0.04	17.7	0.04	NA	
319.7234	10/17/2017	2.161	2.291	0.04	17.7	0.04	NA	
392.0034	10/18/2017	2.62	2.291	0.24	17.7	0.24	NA	
354.8399	10/24/2017	2.397	2.291	0.05	17.7	0.05	NA	
347.8854	10/25/2017	2.354	2.291	0.02	17.7	0.02	NA	
332.9592	10/26/2017	2.253	2.291	0.02	17.7	0.02	NA	
320.1019	10/31/2017	2.166	2.291	0.02	17.7	0.02	NA	

414.4188	11/1/2017	3.165	NA	0.1	15.6	NA	NA	
380.3749	12/5/2017	2.905	3.134	0.1	15.6	0.1		15.6
383.3993	12/6/2017	2.798	3.134	0.83	15.6	0.83	NA	
356.3782	12/7/2017	2.72	3.134	0.11	15.6	0.11	NA	
326.8124	12/12/2017	2.477	3.134	0.22	15.6	0.22	NA	
344.3556	12/13/2017	2.468	3.134	1.13	15.6	1.13	NA	
321.5851	12/14/2017	2.416	3.134	0.36	15.6	0.36	NA	
508.4054	12/17/2017	3.756	3.134	0.63	15.6	0.63	NA	
536.4228	12/20/2017	4.076	3.134	0.18	15.6	0.18	NA	
491.8405	12/21/2017	3.502	3.134	1.24	15.6	1.24	NA	
382.824	12/26/2017	2.844	3.134	0.54	15.6	0.54	NA	
361.6736	12/27/2017	2.707	3.134	0.42	15.6	0.42	NA	
371.6628	12/28/2017	2.714	3.134	0.82	15.6	0.82	NA	
270.9926	1/2/2018	3.077	3.624	0.16	10.4	0.16	NA	
242.8064	1/3/2018	2.794	3.624	0.02	10.4	0.02	NA	
246.8073	1/4/2018	2.73	3.624	0.44	10.4	0.44	NA	
405.1618	1/9/2018	4.357	3.624	0.75	10.4	0.75		10.4
358.7835	1/10/2018	4.047	3.624	0.23	10.4	0.23	NA	
442.9448	1/11/2018	4.959	3.624	0.31	10.4	0.31	NA	
286.5185	1/16/2018	3.297	3.624	0.02	10.4	0.02	NA	
297.8159	1/17/2018	3.427	3.624	0.02	10.4	0.02	NA	
320.3237	1/18/2018	3.686	3.624	0.02	10.4	0.02	NA	
318.4119	1/23/2018	3.664	3.624	0.02	10.4	0.02	NA	
332.9246	1/24/2018	3.831	3.624	0.02	10.4	0.02	NA	
306.2455	1/25/2018	3.524	3.624	0.02	10.4	0.02	NA	
380.1998	1/30/2018	4.375	3.624	0.02	10.4	0.02	NA	
317.369	1/31/2018	3.652	3.624	0.02	10.4	0.02	NA	
228.4586	2/6/2018	4.476	3.74	0.02	6.1	0.02		6.1
358.1108	3/6/2018	2.838	3.08394	1.43	13.7	1.43		13.7
343.4712	4/3/2018	2.98	3.5245	0.12	13.7	0.12		13.7
515.0542	5/8/2018	2.67	2.55	0.13	23	0.13		23
212.474	6/3/2018	2.51	2.47	0.05	10.1	0.05		10.1
226.1618	7/1/2018	2.532	2.2261	0.41	10.3	0.41		10.3
292.3565	7/4/2018	2.359	2.2261	4.56	10.3	4.56	NA	
209.4534	7/5/2018	2.376	2.2261	0.27	10.3	0.27	NA	
293.7263	7/10/2018	2.162	2.2261	5.99	10.3	5.99	NA	
200.3164	7/11/2018	2.135	2.2261	0.95	10.3	0.95	NA	
190.9927	7/12/2018	2.202	2.2261	0.1	10.3	0.1	NA	
193.5107	7/16/2018	2.214	2.2261	0.18	10.3	0.18	NA	
221.226	7/18/2018	2.185	2.2261	1.84	10.3	1.84	NA	
187.5839	7/19/2018	2.106	2.2261	0.38	10.3	0.38	NA	
186.8806	7/24/2018	2.165	2.2261	0.05	10.3	0.05	NA	
183.7967	7/25/2018	2.117	2.2261	0.11	10.3	0.11	NA	
187.9336	7/26/2018	2.173	2.2261	0.07	10.3	0.07	NA	
187.1017	7/31/2018	2.153	2.2261	0.12	10.3	0.12	NA	

234.5099	8/3/2018	2.063	2.15	1.53	12.1	1.53	NA	
240.1578	8/4/2018	2.17	2.15	1.17	12.1	1.17	NA	
256.7746	8/5/2018	2.284	2.15	1.38	12.1	1.38	NA	
238.0621	8/6/2018	2.174	2.15	1.03	12.1	1.03	NA	
236.0911	8/7/2018	2.156	2.15	1.03	12.1	NA		12.1
260.0018	8/11/2018	2.264	2.15	1.67	12.1	1.67	NA	
264.5168	8/12/2018	2.374	2.15	1.26	12.1	1.26	NA	
277.3257	8/13/2018	2.208	2.15	2.96	12.1	2.96	NA	
268.5855	8/16/2018	2.221	2.15	2.4	12.1	2.4	NA	
264.9158	8/19/2018	2.256	2.15	1.98	12.1	1.98	NA	
261.5691	8/21/2018	2.178	2.15	2.3	12.1	2.3	NA	
264.6155	8/25/2018	2.128	2.15	2.81	12.1	2.81	NA	
292.3872	8/26/2018	2.278	2.15	3.29	12.1	3.29	NA	
328.4866	8/27/2018	2.104	2.15	6.62	12.1	6.62	NA	
197.3778	9/3/2018	2.28	2.37	1.35	9.03	1.35	NA	
171.2169	9/4/2018	2.184	2.37	0.37	9.03	0.37		9.03
217.6592	9/5/2018	2.103	2.37	3.38	9.03	3.38	NA	
175.6677	9/11/2018	2.287	2.37	0.18	9.03	0.18	NA	
173.0984	9/12/2018	2.256	2.37	0.17	9.03	0.17	NA	
184.3303	9/13/2018	2.405	2.37	0.16	9.03	0.16	NA	
187.8719	9/17/2018	2.399	2.37	0.36	9.03	0.36	NA	
179.1682	9/18/2018	2.31	2.37	0.27	9.03	0.27	NA	
180.0524	9/19/2018	2.263	2.37	0.51	9.03	0.51	NA	
202.1968	9/25/2018	2.422	2.37	0.98	9.03	0.98	NA	
212.7697	9/26/2018	2.371	2.37	1.73	9.03	1.73	NA	
243.4684	9/27/2018	2.237	2.37	4.02	9.03	4.02	NA	
284.6178	10/2/2018	2.564	2.46	4.66	8.65	4.66		8.65
336.115	10/3/2018	2.522	2.46	7.33	8.65	7.33	NA	
346.9573	10/4/2018	2.43	2.46	8.47	8.65	8.47	NA	
270.1761	10/7/2018	2.651	2.46	3.57	8.65	3.57	NA	
261.6732	10/8/2018	2.668	2.46	3.11	8.65	3.11	NA	
220.394	10/9/2018	2.479	2.46	2.01	8.65	2.01	NA	
225.0046	10/16/2018	2.181	2.46	3.72	8.65	3.72	NA	
253.9226	10/17/2018	2.242	2.46	4.93	8.65	4.93	NA	
275.252	10/18/2018	2.218	2.46	6.23	8.65	6.23	NA	
207.8474	10/23/2018	2.121	2.46	3.1	8.65	3.1	NA	
233.892	10/24/2018	2.174	2.46	4.25	8.65	4.25	NA	
281.0313	10/25/2018	2.92	2.46	2.89	8.65	2.89	NA	
196.9608	10/30/2018	2.567	2.46	0.55	8.65	0.55	NA	
211.415	10/31/2018	2.674	2.46	0.83	8.65	0.83	NA	
238.7358	11/6/2018	3.078	2.954	0.36	8.94	0.36		8.94
261.2013	12/2/2018	3.026	2.94	1.53	8.82	1.53		8.82
351.5373	1/8/2019	3.225	2.88	1.27	11.8	1.27		11.8
215.8686	2/5/2019	2.652	2.93	1.52	8.24	1.52		8.24
347.3587	3/5/2019	2.506	2.68	4.52	12.1	4.52		12.1

321.0837	4/9/2019	2.553	2.76	0.28	14.8	0.28	14.8
460.5919	5/7/2019	2.471	2.47	1.65	20.7	1.65	20.7
483.9135	6/4/2019	2.32	2.35	1.01	24	1.01	24
176.5897	7/1/2019	2.154	2.17	0.03	9.8	0.03	NA
257.6781	7/2/2019	2.771	2.17	1.35	9.8	1.35	NA
193.9255	7/9/2019	2.157	2.17	0.98	9.8	0.98	9.8
192.7207	7/10/2019	2.18	2.17	0.8	9.8	0.8	NA
193.2895	7/11/2019	2.166	2.17	0.9	9.8	0.9	NA
245.9614	7/14/2019	2.253	2.17	3.29	9.8	3.29	NA
221.0897	7/16/2019	2.114	2.17	2.74	9.8	2.74	NA
257.377	7/17/2019	2.121	2.17	4.75	9.8	4.75	NA
214.8718	7/23/2019	2.147	2.17	2.2	9.8	2.2	NA
250.6754	7/24/2019	2.15	2.17	4.18	9.8	4.18	NA
227.8418	7/25/2019	2.141	2.17	2.96	9.8	2.96	NA
204.9318	7/30/2019	2.133	2.17	1.72	9.8	1.72	NA
206.4818	7/31/2019	2.151	2.17	1.71	9.8	1.71	NA
207.5549	8/1/2019	2.067	2.12	1.34	10.7	1.34	NA
207.7974	8/6/2019	2.085	2.12	1.25	10.7	1.25	10.7
213.0742	8/7/2019	2.089	2.12	1.53	10.7	1.53	NA
214.1196	8/8/2019	2.089	2.12	1.59	10.7	1.59	NA
195.794	8/13/2019	2.115	2.12	0.4	10.7	0.4	NA
205.0039	8/14/2019	2.16	2.12	0.68	10.7	0.68	NA
202.0525	8/15/2019	2.076	2.12	0.97	10.7	0.97	NA
194.7013	8/20/2019	2.077	2.12	0.54	10.7	0.54	NA
220.7807	8/21/2019	2.147	2.12	1.63	10.7	1.63	NA
205.2105	8/22/2019	2.123	2.12	0.89	10.7	0.89	NA
225.9653	8/25/2019	2.273	2.12	1.22	10.7	1.22	NA
200.0399	8/27/2019	2.104	2.12	0.7	10.7	0.7	NA
206.0957	8/28/2019	2.134	2.12	0.88	10.7	0.88	NA
248.4466	9/2/2019	2.288	2.441	3.76	9.26	3.76	NA
192.8455	9/3/2019	2.198	2.441	1.26	9.26	1.26	NA
202.466	9/4/2019	2.111	2.441	2.24	9.26	2.24	NA
204.1065	9/10/2019	2.36	2.441	1.11	9.26	1.11	9.26
186.1038	9/11/2019	2.277	2.441	0.54	9.26	0.54	NA
202.5242	9/12/2019	2.278	2.441	1.4	9.26	1.4	NA
210.1657	9/17/2019	2.548	2.441	0.63	9.26	0.63	NA
250.5723	9/18/2019	2.544	2.441	2.55	9.26	2.55	NA
231.0809	9/19/2019	2.401	2.441	2.28	9.26	2.28	NA
199.7997	9/24/2019	2.576	2.441	0.04	9.26	0.04	NA
192.0171	9/25/2019	2.473	2.441	0.05	9.26	0.05	NA
207.225	9/26/2019	2.666	2.441	0.06	9.26	0.06	NA
203.7624	9/30/2019	2.561	2.441	0.28	9.26	0.28	NA
374.4909	10/1/2019	2.391	2.58	1.08	17.7	1.08	17.7
415.0808	10/2/2019	2.361	2.58	3.38	17.7	3.38	NA
395.1786	10/6/2019	2.571	2.58	0.73	17.7	0.73	NA

410.5365	10/7/2019	2.75	2.58	0.2	17.7	0.2	NA
422.0819	10/8/2019	2.682	2.58	1.17	17.7	1.17	NA
364.9793	10/15/2019	2.334	2.58	1.05	17.7	1.05	NA
371.6487	10/16/2019	2.462	2.58	0.4	17.7	0.4	NA
368.9927	10/17/2019	2.487	2.58	0.09	17.7	0.09	NA
501.9454	10/22/2019	3.385	2.58	0.08	17.7	0.08	NA
434.4368	10/23/2019	2.938	2.58	0.03	17.7	0.03	NA
408.1162	10/24/2019	2.76	2.58	0.03	17.7	0.03	NA
348.135	10/29/2019	2.332	2.58	0.2	17.7	0.2	NA
367.2471	10/30/2019	2.346	2.58	1.07	17.7	1.07	NA
337.7838	10/31/2019	2.269	2.58	0.15	17.7	0.15	NA
303.4225	11/5/2019	2.232	2.52	0.3	16	0.3	16
242.6564	12/3/2019	2.311	2.94	0.09	12.5	0.09	12.5
472.0601	1/7/2020	3.531	3.42	0.13	15.9	0.13	15.9
797.7063	2/5/2020	6.911	3.64	0.04	13.8	0.04	13.8
319.8974	3/3/2020	3.17	2.83	0.1	12	0.1	12
53.50469	4/14/2020	2.477	2.6	2.22	0.37	2.22	0.37
283.2652	5/5/2020	2.715	2.72	0.31	12.2	0.31	12.2
606.3092	6/9/2020	3.306	3.035	12.9	9.09	12.9	9.09
372.7032	7/1/2020	2.649	2.45	0.07	16.8	0.07	NA
363.0696	7/7/2020	2.579	2.45	0.08	16.8	0.08	16.8
352.2296	7/8/2020	2.502	2.45	0.08	16.8	0.08	NA
347.0411	7/9/2020	2.471	2.45	0.04	16.8	0.04	NA
460.9168	7/14/2020	2.74	2.45	3.37	16.8	3.37	NA
349.1331	7/15/2020	2.424	2.45	0.47	16.8	0.47	NA
346.6213	7/16/2020	2.401	2.45	0.51	16.8	0.51	NA
351.5506	7/21/2020	2.455	2.45	0.37	16.8	0.37	NA
338.114	7/22/2020	2.375	2.45	0.27	16.8	0.27	NA
327.465	7/23/2020	2.333	2.45	0.03	16.8	0.03	NA
331.058	7/28/2020	2.36	2.45	0.02	16.8	0.02	NA
331.4788	7/29/2020	2.363	2.45	0.02	16.8	0.02	NA
322.7815	7/30/2020	2.301	2.45	0.02	16.8	0.02	NA
302.7207	8/2/2020	2.415	2.295	0.03	15	0.03	NA
294.5715	8/3/2020	2.336	2.295	0.12	15	0.12	NA
292.5233	8/4/2020	2.329	2.295	0.06	15	0.06	NA
286.7357	8/11/2020	2.289	2.295	0.02	15	0.02	15
286.6201	8/12/2020	2.282	2.295	0.06	15	0.06	NA
286.6104	8/13/2020	2.288	2.295	0.02	15	0.02	NA
289.877	8/18/2020	2.311	2.295	0.04	15	0.04	NA
288.6147	8/19/2020	2.304	2.295	0.02	15	0.02	NA
282.3514	8/20/2020	2.254	2.295	0.02	15	0.02	NA
277.8418	8/25/2020	2.218	2.295	0.02	15	0.02	NA
269.0731	8/26/2020	2.148	2.295	0.02	15	0.02	NA
276.2133	8/27/2020	2.205	2.295	0.02	15	0.02	NA
290.1279	8/30/2020	2.313	2.295	0.04	15	0.04	NA

289.8097	8/31/2020	2.312	2.295	0.03	15	0.03	NA	
240.6273	9/1/2020	2.34	2.37	0.03	12.3	0.03	NA	
243.8549	9/7/2020	2.358	2.37	0.1	12.3	0.1	NA	
234.8217	9/8/2020	2.278	2.37	0.06	12.3	0.06	NA	
228.1214	9/9/2020	2.213	2.37	0.06	12.3	0.06	NA	
243.2009	9/15/2020	2.346	2.37	0.13	12.3	0.13		12.3
237.735	9/16/2020	2.31	2.37	0.04	12.3	0.04	NA	
237.735	9/17/2020	2.31	2.37	0.04	12.3	0.04	NA	
241.3371	9/22/2020	2.345	2.37	0.04	12.3	0.04	NA	
265.2224	9/23/2020	2.575	2.37	0.05	12.3	0.05	NA	
253.3692	9/24/2020	2.45	2.37	0.1	12.3	0.1	NA	
255.8482	9/28/2020	2.486	2.37	0.04	12.3	0.04	NA	
249.1546	9/29/2020	2.419	2.37	0.05	12.3	0.05	NA	
247.1916	9/30/2020	2.398	2.37	0.06	12.3	0.06	NA	
185.1221	10/6/2020	2.374	2.68	0.29	9.06	0.29		9.06
182.5809	10/7/2020	2.354	2.68	0.24	9.06	0.24	NA	
185.555	10/8/2020	2.32	2.68	0.53	9.06	0.53	NA	
218.5747	10/11/2020	2.88	2.68	0.04	9.06	0.04	NA	
206.9624	10/12/2020	2.724	2.68	0.05	9.06	0.05	NA	
213.3445	10/13/2020	2.808	2.68	0.05	9.06	0.05	NA	
277.6144	10/18/2020	3.63	2.68	0.11	9.06	0.11	NA	
251.2573	10/19/2020	3.307	2.68	0.05	9.06	0.05	NA	
227.1724	10/20/2020	2.99	2.68	0.05	9.06	0.05	NA	
195.11	10/27/2020	2.568	2.68	0.05	9.06	0.05	NA	
193.8029	10/28/2020	2.548	2.68	0.06	9.06	0.06	NA	
190.9126	10/29/2020	2.51	2.68	0.06	9.06	0.06	NA	
330.608	11/3/2020	2.883	3.05	0.15	13.6	0.15		13.6

ATTACHMENT B

REVISED PERMIT ACTION LEVEL ALTERNATIVE 1

Data, Controls, Numeric Output

significant digits to display

3

398 Daily

Fix Random number Seed

145,000 Annual

Action Level based on 597 data points Over 1800 days

Please select Data file

Browse... WA0020893DAYmp002_PlantProcess(alt1).csv

Upload complete

Earliest Data to consider for calculation

2014-01-01

Latest Data to consider for calculation

2021-03-11

Samples per month (per year/12)

1 4 30

Thousands of iterations

4 34 100

Confidence Level Needed

90 99

If Date is not second field input, data assumed to be sequential months starting in Jan 2015

WA0020893DAYmp002_PlantProcess(alt1).csv

DataTable Summary Individual Annual Version Help

first month of year

Jan

Extrapolate data to ends of year

load	POS	Q2	Qave	AMM	NIT	Ammonia	Nitrate...Nitrite
297.7915	1/5/2016	2.511	3.12294	0.02	14.2	0.02	14.2
540.1278	2/2/2016	2.848	2.97866	0.04	22.7	0.04	22.7
392.5671	3/1/2016	2.92	3.07742	0.02	16.1	0.02	16.1
256.8628	4/19/2016	2.295	2.43637	0.02	13.4	0.02	13.4
252.4835	5/3/2016	2.29	2.22839	0.02	13.2	0.02	13.2
224.8998	6/7/2016	2.12	2.1628	0.02	12.7	0.02	12.7
214.6773	7/5/2016	2.254	2.09394	0.02	11.4	0.02	11.4
187.8929	8/2/2016	2.026	2.05555	0.02	11.1	0.02	11.1
241.3519	8/3/2016	2.073	2.05555	0.06	13.9	0.06	13.9
202.234	8/4/2016	2.069	2.05555	0.02	11.7	0.02	11.7
221.8307	8/9/2016	2.078	2.05555	0.4	12.4	0.4	12.4
221.0961	8/10/2016	2.033	2.05555	0.04	13	0.04	13
157.1263	8/11/2016	1.979	2.05555	0.02	9.5	0.02	9.5
167.1816	8/16/2016	2.128	2.05555	0.02	9.4	0.02	9.4
203.7399	8/17/2016	2.046	2.05555	0.14	11.8	0.14	11.8
248.2244	8/18/2016	2.033	2.05555	0.24	14.4	0.24	14.4
173.1119	8/23/2016	2.031	2.05555	0.02	10.2	0.02	10.2
213.3894	8/24/2016	2.042	2.05555	0.03	12.5	0.03	12.5
254.9905	8/25/2016	1.97	2.05555	0.02	15.5	0.02	15.5
205.0439	8/30/2016	2.08	2.05555	0.02	11.8	0.02	11.8
275.0138	8/31/2016	2.028	2.05555	0.16	16.1	0.16	16.1
166.9885	9/6/2016	2.21	2.2469	0.02	9.04	0.02	9.04
300.7656	10/4/2016	2.401	2.80587	0.02	15	0.02	15
248.9575	10/9/2016	2.598	2.80587	0.09	11.4	0.09	11.4
224.1545	10/10/2016	2.417	2.80587	0.02	11.1	0.02	11.1
363.4462	10/25/2016	2.654	2.80587	0.02	16.4	0.02	16.4
628.5941	10/26/2016	3.335	2.80587	0.4	22.2	0.4	22.2
501.629	10/27/2016	3.213	2.80587	0.02	18.7	0.02	18.7
418.8628	11/1/2016	3.608	3.4292	0.02	13.9	0.02	13.9
414.3465	11/3/2016	3.082	3.4292	0.02	16.1	0.02	16.1
337.0239	11/7/2016	2.967	3.4292	0.02	13.6	0.02	13.6
354.814	11/8/2016	2.777	3.4292	0.02	15.3	0.02	15.3
323.9503	11/9/2016	2.873	3.4292	0.02	13.5	0.02	13.5
456.4727	11/15/2016	4.337	3.4292	0.02	12.6	0.02	12.6
537.7098	11/16/2016	3.68	3.4292	0.02	17.5	0.02	17.5
576.9969	11/17/2016	3.242	3.4292	0.04	21.3	0.04	21.3
401.1552	11/20/2016	3.366	3.4292	0.09	14.2	0.09	14.2
369.1162	11/21/2016	3.019	3.4292	0.06	14.6	0.06	14.6
391.6544	11/22/2016	3.232	3.4292	0.03	14.5	0.03	14.5
433.6627	11/29/2016	3.846	3.4292	0.02	13.5	0.02	13.5
516.5404	11/30/2016	3.915	3.4292	0.02	15.8	0.02	15.8
506.6041	12/1/2016	3.745	3.18406	0.02	16.2	0.02	16.2
432.7072	12/6/2016	3.343	3.18406	0.02	15.5	0.02	15.5
514.7851	12/7/2016	3.167	3.18406	0.09	19.4	0.09	19.4

496.5799	12/8/2016	3.055	3.18406	0.09	19.4	0.09	19.4
346.1772	12/13/2016	3.093	3.18406	0.02	13.4	0.02	13.4
353.7481	12/14/2016	2.962	3.18406	0.02	14.3	0.02	14.3
529.4085	12/15/2016	2.888	3.18406	0.18	21.8	0.18	21.8
283.4141	12/19/2016	2.875	3.18406	0.02	11.8	0.02	11.8
451.7071	12/20/2016	2.884	3.18406	0.08	18.7	0.08	18.7
377.7532	12/27/2016	3.113	3.18406	0.05	14.5	0.05	14.5
341.4605	12/28/2016	2.969	3.18406	0.09	13.7	0.09	13.7
413.5035	12/29/2016	3.142	3.18406	0.18	15.6	0.18	15.6
426.7072	1/3/2017	2.913	2.83858	0.864	16.7	0.864	16.7
390.1681	1/4/2017	2.793	2.83858	0.05	16.7	0.05	16.7
304.05	1/5/2017	2.737	2.83858	0.02	13.3	0.02	13.3
458.7377	1/10/2017	2.742	2.83858	0.66	19.4	0.66	19.4
510.3753	1/11/2017	2.824	2.83858	0.07	21.6	0.07	21.6
470.5737	1/12/2017	2.611	2.83858	0.71	20.9	0.71	20.9
268.572	1/17/2017	3.004	2.83858	0.02	10.7	0.02	10.7
636.1155	1/18/2017	3.717	2.83858	1.12	19.4	1.12	19.4
469.4895	1/19/2017	3.49	2.83858	0.03	16.1	0.03	16.1
415.9106	1/24/2017	2.705	2.83858	0.036	18.4	0.036	18.4
560.6213	1/25/2017	2.736	2.83858	0.869	23.7	0.869	23.7
491.5954	1/26/2017	2.726	2.83858	0.023	21.6	0.023	21.6
517.6522	1/31/2017	2.555	2.83858	0.093	24.2	0.093	24.2
402.4231	2/1/2017	2.551	3.23468	0.015	18.9	0.015	18.9
484.3733	2/2/2017	2.509	3.23468	0.448	22.7	0.448	22.7
382.524	2/7/2017	2.936	3.23468	0.022	15.6	0.022	15.6
356.4386	2/8/2017	3.258	3.23468	0.018	13.1	0.018	13.1
658.3789	2/9/2017	3.989	3.23468	0.29	19.5	0.29	19.5
430.4786	2/14/2017	3.062	3.23468	0.857	16	0.857	16
498.2869	2/15/2017	4.129	3.23468	0.07	14.4	0.07	14.4
558.4894	2/16/2017	4.02	3.23468	0.158	16.5	0.158	16.5
383.3339	2/21/2017	3.311	3.23468	0.082	13.8	0.082	13.8
319.039	2/22/2017	3.264	3.23468	0.02	11.7	0.02	11.7
319.1386	2/23/2017	3.081	3.23468	0.02	12.4	0.02	12.4
532.4186	2/28/2017	3.087	3.23468	0.78	19.9	0.78	19.9
473.635	3/1/2017	3.092	3.55358	0.467	17.9	0.467	17.9
340.0501	3/2/2017	3.014	3.55358	0.028	13.5	0.028	13.5
480.5026	3/7/2017	3.702	3.55358	0.463	15.1	0.463	15.1
530.546	3/8/2017	3.498	3.55358	0.386	17.8	0.386	17.8
588.9633	3/9/2017	3.586	3.55358	0.193	19.5	0.193	19.5
348.3854	3/14/2017	3.825	3.55358	0.021	10.9	0.021	10.9
414.2561	3/15/2017	4.379	3.55358	0.043	11.3	0.043	11.3
387.0117	3/16/2017	3.83	3.55358	0.016	12.1	0.016	12.1
440.5365	3/21/2017	3.375	3.55358	0.151	15.5	0.151	15.5
469.7554	3/22/2017	3.188	3.55358	0.768	16.9	0.768	16.9
523.3032	3/23/2017	3.077	3.55358	0.492	19.9	0.492	19.9

286.1064	3/28/2017	3.358	3.55358	0.016	10.2	0.016	10.2
529.788	3/29/2017	4.002	3.55358	0.173	15.7	0.173	15.7
486.2088	3/30/2017	4.186	3.55358	0.027	13.9	0.027	13.9
364.8508	4/4/2017	3.117	3.26913	0.035	14	0.035	14
309.3084	4/5/2017	3.249	3.26913	0.015	11.4	0.015	11.4
299.2171	4/6/2017	3.143	3.26913	0.015	11.4	0.015	11.4
555.2261	4/11/2017	3.076	3.26913	0.143	21.5	0.143	21.5
562.4537	4/12/2017	3.763	3.26913	0.022	17.9	0.022	17.9
483.0354	4/13/2017	3.757	3.26913	0.016	15.4	0.016	15.4
241.0983	4/18/2017	2.858	3.26913	0.015	10.1	0.015	10.1
249.3224	4/19/2017	2.985	3.26913	0.015	10	0.015	10
570.2751	4/20/2017	3.861	3.26913	0.31	17.4	0.31	17.4
286.4402	4/25/2017	3.09	3.26913	0.015	11.1	0.015	11.1
335.4768	4/26/2017	3.376	3.26913	0.015	11.9	0.015	11.9
602.362	4/27/2017	3.193	3.26913	1.12	21.5	1.12	21.5
413.6428	5/2/2017	2.828	2.92835	0.038	17.5	0.038	17.5
258.4375	5/3/2017	2.947	2.92835	0.015	10.5	0.015	10.5
226.8469	5/4/2017	3.311	2.92835	0.015	8.2	0.015	8.2
258.7755	5/9/2017	2.869	2.92835	0.015	10.8	0.015	10.8
467.507	5/10/2017	2.8	2.92835	1.72	18.3	1.72	18.3
459.6346	5/11/2017	2.842	2.92835	0.092	19.3	0.092	19.3
327.1449	5/16/2017	3.627	2.92835	0.015	10.8	0.015	10.8
413.4631	5/18/2017	3.022	2.92835	0.105	16.3	0.105	16.3
370.3716	5/23/2017	2.844	2.92835	0.415	15.2	0.415	15.2
530.1911	5/24/2017	2.783	2.92835	0.143	22.7	0.143	22.7
372.7784	5/25/2017	2.843	2.92835	0.022	15.7	0.022	15.7
183.3326	5/30/2017	2.621	2.92835	0.087	8.3	0.087	8.3
186.3723	5/31/2017	2.576	2.92835	0.075	8.6	0.075	8.6
192.3638	6/1/2017	2.58	2.41167	0.04	8.9	0.04	8.9
391.4591	6/6/2017	2.473	2.41167	0.08	18.9	0.08	18.9
414.5547	6/7/2017	2.42	2.41167	0.14	20.4	0.14	20.4
267.9702	6/8/2017	2.526	2.41167	0.02	12.7	0.02	12.7
442.5724	6/13/2017	2.432	2.41167	0.02	21.8	0.02	21.8
407.5818	6/14/2017	2.556	2.41167	0.02	19.1	0.02	19.1
408.6021	6/15/2017	2.423	2.41167	0.02	20.2	0.02	20.2
443.3574	6/20/2017	2.346	2.41167	0.06	22.6	0.06	22.6
422.6904	6/21/2017	2.41	2.41167	0.13	20.9	0.13	20.9
459.4244	6/22/2017	2.302	2.41167	0.03	23.9	0.03	23.9
240.2085	6/27/2017	2.319	2.41167	0.02	12.4	0.02	12.4
240.6807	6/28/2017	2.305	2.41167	0.02	12.5	0.02	12.5
260.9192	6/29/2017	2.314	2.41167	0.02	13.5	0.02	13.5
315.8445	7/4/2017	2.298	2.21252	0.08	16.4	0.08	16.4
363.8046	7/5/2017	2.325	2.21252	0.462	18.3	0.462	18.3
268.3069	7/11/2017	2.453	2.21252	0.015	13.1	0.015	13.1
416.72	8/1/2017	2.109	2.08839	0.192	23.5	0.192	23.5

322.1175	8/2/2017	2.09	2.08839	0.08	18.4	0.08	18.4
493.2384	8/3/2017	2.082	2.08839	0.806	27.6	0.806	27.6
502.752	8/8/2017	2.083	2.08839	1.84	27.1	1.84	27.1
497.589	8/9/2017	2.036	2.08839	0.404	28.9	0.404	28.9
331.9212	8/10/2017	2.234	2.08839	0.015	17.8	0.015	17.8
526.1914	8/15/2017	2.149	2.08839	0.559	28.8	0.559	28.8
341.5068	8/16/2017	2.077	2.08839	0.015	19.7	0.015	19.7
408.6392	8/17/2017	2.085	2.08839	0.5	23	0.5	23
197.9231	8/21/2017	2.079	2.08839	0.015	11.4	0.015	11.4
207.7162	8/22/2017	2.108	2.08839	0.015	11.8	0.015	11.8
330.4838	8/23/2017	2.107	2.08839	0.307	18.5	0.307	18.5
317.5117	9/12/2017	2.058	2.09257	0.099	18.4	0.099	18.4
221.95	9/13/2017	2.161	2.09257	0.015	12.3	0.015	12.3
178.7359	9/14/2017	2.018	2.09257	0.02	10.6	0.02	10.6
270.9369	9/19/2017	2.149	2.09257	0.017	15.1	0.017	15.1
278.4697	9/20/2017	2.063	2.09257	0.015	16.17	0.015	16.17
298.6989	9/21/2017	2.073	2.09257	0.077	17.2	0.077	17.2
168.7075	9/26/2017	2.061	2.09257	0.015	9.8	0.015	9.8
194.3962	9/27/2017	2.06	2.09257	0.015	11.3	0.015	11.3
186.5106	9/28/2017	2.012	2.09257	0.015	11.1	0.015	11.1
351.6004	10/3/2017	2.055	2.291	0.015	20.5	0.015	20.5
281.4531	11/1/2017	2.325	NA	0.015	14.5	0.015	14.5
350.8232	11/2/2017	2.37	NA	0.049	17.7	0.049	17.7
255.1031	11/6/2017	2.507	NA	0.301	11.9	0.301	11.9
343.4372	11/7/2017	2.368	NA	1.19	16.2	1.19	16.2
262.9916	11/8/2017	2.331	NA	0.028	13.5	0.028	13.5
504.7145	11/15/2017	3.505	NA	0.366	16.9	0.366	16.9
458.264	11/16/2017	2.846	NA	0.407	18.9	0.407	18.9
301.0809	11/19/2017	2.837	NA	0.325	12.4	0.325	12.4
330.6635	11/20/2017	3.084	NA	0.056	12.8	0.056	12.8
434.3144	11/21/2017	3.656	NA	0.044	14.2	0.044	14.2
375.6584	11/28/2017	3.878	NA	0.015	11.6	0.015	11.6
346.8627	11/29/2017	3.35	NA	0.015	12.4	0.015	12.4
517.0583	11/30/2017	3.56	NA	0.015	17.4	0.015	17.4
409.3997	12/5/2017	2.905	3.134	0.098	16.8	0.098	16.8
581.6562	12/6/2017	2.798	3.134	0.826	24.1	0.826	24.1
431.1927	12/7/2017	2.72	3.134	0.108	18.9	0.108	18.9
314.3968	12/12/2017	2.477	3.134	0.219	15	0.219	15
484.3208	12/13/2017	2.468	3.134	1.13	22.4	1.13	22.4
450.4609	12/14/2017	2.416	3.134	0.356	22	0.356	22
370.5126	12/17/2017	3.756	3.134	0.628	11.2	0.628	11.2
505.7604	12/20/2017	4.076	3.134	0.178	14.7	0.178	14.7
500.6025	12/21/2017	3.502	3.134	1.24	15.9	1.24	15.9
231.0938	12/26/2017	2.844	3.134	0.543	9.2	0.543	9.2
239.7612	12/27/2017	2.707	3.134	0.42	10.2	0.42	10.2

294.6593	12/28/2017	2.714	3.134	0.818	12.2	0.818	12.2
245.2278	1/2/2018	3.077	3.624	0.156	9.4	0.156	9.4
203.263	1/3/2018	2.794	3.624	0.023	8.7	0.023	8.7
255.9601	1/4/2018	2.73	3.624	0.442	10.8	0.442	10.8
394.2969	1/9/2018	4.357	3.624	0.751	10.1	0.751	10.1
429.764	1/10/2018	4.047	3.624	0.233	12.5	0.233	12.5
488.5214	1/11/2018	4.959	3.624	0.312	11.5	0.312	11.5
209.3895	1/16/2018	3.297	3.624	0.015	7.6	0.015	7.6
226.22	1/17/2018	3.427	3.624	0.015	7.9	0.015	7.9
221.798	1/18/2018	3.686	3.624	0.015	7.2	0.015	7.2
226.5858	1/23/2018	3.664	3.624	0.015	7.4	0.015	7.4
230.5231	1/24/2018	3.831	3.624	0.015	7.2	0.015	7.2
241.4402	1/25/2018	3.524	3.624	0.015	8.2	0.015	8.2
288.7986	1/30/2018	4.375	3.624	0.015	7.9	0.015	7.9
256.3014	1/31/2018	3.652	3.624	0.015	8.4	0.015	8.4
433.8048	2/1/2018	3.726	3.74	1.76	12.2	1.76	12.2
265.6018	2/6/2018	4.476	3.74	0.015	7.1	0.015	7.1
371.831	2/7/2018	4.059	3.74	0.484	10.5	0.484	10.5
475.4747	2/8/2018	3.736	3.74	1.06	14.2	1.06	14.2
301.3591	2/13/2018	3.021	3.74	0.261	11.7	0.261	11.7
333.3962	2/14/2018	3.196	3.74	0.608	11.9	0.608	11.9
317.7422	2/15/2018	2.998	3.74	0.308	12.4	0.308	12.4
219.8916	2/20/2018	3.461	3.74	0.018	7.6	0.018	7.6
247.7147	2/21/2018	3.294	3.74	0.017	9	0.017	9
232.8798	2/22/2018	2.989	3.74	0.042	9.3	0.042	9.3
320.2038	2/27/2018	2.996	3.74	0.015	12.8	0.015	12.8
477.1398	2/28/2018	3.186	3.74	0.457	17.5	0.457	17.5
467.8956	3/1/2018	3.196	3.08394	0.154	17.4	0.154	17.4
384.1466	3/6/2018	2.838	3.08394	1.43	14.8	1.43	14.8
334.4518	3/7/2018	2.767	3.08394	0.393	14.1	0.393	14.1
429.0895	3/8/2018	3.49	3.08394	0.742	14	0.742	14
345.4511	3/13/2018	3	3.08394	0.807	13	0.807	13
483.9916	3/14/2018	3.005	3.08394	0.612	18.7	0.612	18.7
353.4791	3/15/2018	2.938	3.08394	0.026	14.4	0.026	14.4
452.6957	3/20/2018	2.624	3.08394	0.186	20.5	0.186	20.5
390.2512	3/21/2018	2.621	3.08394	0.053	17.8	0.053	17.8
438.6573	3/22/2018	2.931	3.08394	0.045	17.9	0.045	17.9
694.5532	3/27/2018	3.729	3.08394	0.533	21.8	0.533	21.8
741.9288	3/28/2018	3.478	3.08394	0.478	25.1	0.478	25.1
474.2308	3/29/2018	3.174	3.08394	0.015	17.9	0.015	17.9
385.7217	4/3/2018	2.98	3.5245	0.12	15.4	0.12	15.4
549.5935	4/4/2018	3.306	3.5245	0.533	19.4	0.533	19.4
531.9035	4/5/2018	3.56	3.5245	0.015	17.9	0.015	17.9
566.9059	4/10/2018	3.506	3.5245	0.288	19.1	0.288	19.1
725.0496	4/11/2018	3.534	3.5245	0.7	23.9	0.7	23.9

671.0012	4/12/2018	3.557	3.5245	0.519	22.1	0.519	22.1
425.5922	4/15/2018	4.92	3.5245	0.072	10.3	0.072	10.3
603.4126	4/16/2018	5.265	3.5245	0.442	13.3	0.442	13.3
590.5415	4/17/2018	4.573	3.5245	0.684	14.8	0.684	14.8
272.1383	4/24/2018	2.833	3.5245	0.018	11.5	0.018	11.5
301.5945	4/25/2018	2.797	3.5245	0.029	12.9	0.029	12.9
434.1614	4/26/2018	2.705	3.5245	0.945	18.3	0.945	18.3
478.4953	5/1/2018	2.66	2.55	0.069	21.5	0.069	21.5
373.2621	5/2/2018	2.71	2.55	0.015	16.5	0.015	16.5
322.0066	5/3/2018	2.66	2.55	0.015	14.5	0.015	14.5
550.5714	5/8/2018	2.67	2.55	0.125	24.6	0.125	24.6
453.9081	5/9/2018	2.661	2.55	0.053	20.4	0.053	20.4
375.6914	5/10/2018	2.695	2.55	0.015	16.7	0.015	16.7
287.1764	5/15/2018	2.683	2.55	0.034	12.8	0.034	12.8
240.8323	5/16/2018	2.573	2.55	0.023	11.2	0.023	11.2
227.7308	5/17/2018	2.546	2.55	0.025	10.7	0.025	10.7
228.7513	5/20/2018	2.657	2.55	0.223	10.1	0.223	10.1
496.7146	5/22/2018	2.513	2.55	1.7	22	1.7	22
306.9656	5/23/2018	2.433	2.55	0.028	15.1	0.028	15.1
244.1749	5/29/2018	2.478	2.55	0.015	11.8	0.015	11.8
432.3226	5/30/2018	2.444	2.55	1.11	20.1	1.11	20.1
568.6574	5/31/2018	2.409	2.55	0.704	27.6	0.704	27.6
406.3226	6/5/2018	2.386	2.47	0.019	20.4	0.019	20.4
273.1087	6/6/2018	2.423	2.47	0.015	13.5	0.015	13.5
383.7867	6/7/2018	2.381	2.47	0.627	18.7	0.627	18.7
225.4209	6/12/2018	2.646	2.47	0.015	10.2	0.015	10.2
268.218	6/13/2018	2.722	2.47	0.015	11.8	0.015	11.8
231.7475	6/14/2018	2.667	2.47	0.019	10.4	0.019	10.4
247.5974	6/19/2018	3.03	2.47	0.298	9.5	0.298	9.5
202.3793	6/20/2018	2.35	2.47	0.826	9.5	0.826	9.5
524.3441	6/21/2018	2.206	2.47	12.6	15.9	12.6	15.9
346.4417	6/25/2018	3.088	2.47	0.752	12.7	0.752	12.7
247.1716	6/26/2018	2.184	2.47	0.27	13.3	0.27	13.3
225.4481	6/27/2018	2.124	2.47	0.227	12.5	0.227	12.5
320.3383	6/28/2018	2.261	2.47	0.788	16.2	0.788	16.2
245.0614	7/1/2018	2.532	2.2261	0.405	11.2	0.405	11.2
418.2705	7/4/2018	2.359	2.2261	4.56	16.7	4.56	16.7
304.6091	7/5/2018	2.376	2.2261	0.272	15.1	0.272	15.1
445.1874	7/10/2018	2.162	2.2261	5.99	18.7	5.99	18.7
231.3031	7/12/2018	2.202	2.2261	0.095	12.5	0.095	12.5
202.7061	7/16/2018	2.214	2.2261	0.178	10.8	0.178	10.8
283.1839	7/18/2018	2.185	2.2261	1.84	13.7	1.84	13.7
172.3455	7/24/2018	2.165	2.2261	0.045	9.5	0.045	9.5
176.6637	7/25/2018	2.117	2.2261	0.106	9.9	0.106	9.9
178.9085	7/26/2018	2.173	2.2261	0.072	9.8	0.072	9.8

187.1017	7/31/2018	2.153	2.2261	0.12	10.3	0.12	10.3
204.3296	8/1/2018	2.177	2.15	0.454	10.8	0.454	10.8
257.9629	8/2/2018	2.12	2.15	1.69	12.9	1.69	12.9
230.2113	8/7/2018	2.156	2.15	0.303	12.5	0.303	12.5
331.1407	8/8/2018	2.121	2.15	4.22	14.5	4.22	14.5
288.8736	8/9/2018	2.209	2.15	1.48	14.2	1.48	14.2
140.7647	8/14/2018	2.017	2.15	0.268	8.1	0.268	8.1
281.3332	8/15/2018	2.212	2.15	4.15	11.1	4.15	11.1
280.6418	8/21/2018	2.178	2.15	3.05	12.4	3.05	12.4
225.3171	8/22/2018	2.134	2.15	1.46	11.2	1.46	11.2
238.2084	8/23/2018	2.046	2.15	1.96	12	1.96	12
201.9661	8/28/2018	2.168	2.15	1.07	10.1	1.07	10.1
192.4609	8/29/2018	2.05	2.15	0.857	10.4	0.857	10.4
285.5566	8/30/2018	2.026	2.15	5.6	11.3	5.6	11.3
208.2164	9/3/2018	2.28	2.37	1.35	9.6	1.35	9.6
194.404	9/4/2018	2.184	2.37	0.373	10.3	0.373	10.3
269.7501	9/5/2018	2.103	2.37	3.38	12	3.38	12
187.4108	9/25/2018	2.422	2.37	0.978	8.3	0.978	8.3
184.4927	9/26/2018	2.371	2.37	1.73	7.6	1.73	7.6
233.5804	9/27/2018	2.237	2.37	4.02	8.5	4.02	8.5
277.1335	10/2/2018	2.564	2.46	4.66	8.3	4.66	8.3
396.0604	10/3/2018	2.522	2.46	7.33	11.5	7.33	11.5
414.8491	10/4/2018	2.43	2.46	8.47	12	8.47	12
262.4379	10/7/2018	2.651	2.46	3.57	8.3	3.57	8.3
251.6602	10/8/2018	2.668	2.46	3.11	8.2	3.11	8.2
201.6562	10/23/2018	2.121	2.46	3.1	8.3	3.1	8.3
258.369	10/24/2018	2.174	2.46	4.25	10	4.25	10
352.8721	10/25/2018	2.92	2.46	2.89	11.6	2.89	11.6
225.8412	10/30/2018	2.567	2.46	0.549	10	0.549	10
261.5703	10/31/2018	2.674	2.46	0.829	10.9	0.829	10.9
292.7719	11/1/2018	3.313	2.954	0.896	9.7	0.896	9.7
258.1941	11/6/2018	3.078	2.954	0.358	9.7	0.358	9.7
268.8833	11/7/2018	2.904	2.954	0.402	10.7	0.402	10.7
261.8538	11/8/2018	2.648	2.954	0.857	11	0.857	11
245.6735	11/13/2018	2.409	2.954	0.928	11.3	0.928	11.3
306.9754	11/14/2018	2.487	2.954	3.2	11.6	3.2	11.6
346.5753	11/15/2018	2.551	2.954	4.19	12.1	4.19	12.1
289.9755	11/18/2018	2.727	2.954	3.15	9.6	3.15	9.6
233.1249	11/19/2018	2.498	2.954	1.69	9.5	1.69	9.5
238.5553	11/20/2018	2.335	2.954	1.65	10.6	1.65	10.6
289.984	11/27/2018	3.535	2.954	0.636	9.2	0.636	9.2
387.0401	11/28/2018	3.296	2.954	2.48	11.6	2.48	11.6
374.4984	11/29/2018	3.114	2.954	2.72	11.7	2.72	11.7
243.7207	12/4/2018	2.593	2.94	1.17	10.1	1.17	10.1
229.0257	12/5/2018	2.524	2.94	1.38	9.5	1.38	9.5

224.7	12/6/2018	2.465	2.94	1.03	9.9	1.03	9.9
219.2814	12/11/2018	2.719	2.94	1.67	8	1.67	8
215.7817	12/12/2018	2.735	2.94	1.26	8.2	1.26	8.2
270.0098	12/13/2018	2.753	2.94	2.96	8.8	2.96	8.8
288.5426	12/16/2018	3.516	2.94	2.44	7.4	2.44	7.4
261.1474	12/19/2018	2.878	2.94	1.98	8.9	1.98	8.9
265.0822	12/21/2018	2.908	2.94	2.33	8.6	2.33	8.6
214.3806	12/25/2018	2.791	2.94	2.81	6.4	2.81	6.4
226.2498	12/26/2018	2.743	2.94	3.29	6.6	3.29	6.6
300.3651	12/27/2018	2.625	2.94	6.62	7.1	6.62	7.1
205.4993	1/1/2019	3.042	2.88	1.4	6.7	1.4	6.7
187.4386	1/2/2019	2.827	2.88	1.25	6.7	1.25	6.7
241.6654	1/3/2019	2.889	2.88	1.93	8.1	1.93	8.1
381.1234	1/8/2019	3.225	2.88	1.27	12.9	1.27	12.9
492.8793	1/9/2019	3.452	2.88	1.22	15.9	1.22	15.9
484.8658	1/10/2019	3.347	2.88	1.17	16.2	1.17	16.2
297.2376	1/15/2019	2.64	2.88	1.9	11.6	1.9	11.6
416.4079	1/16/2019	2.67	2.88	4.5	14.2	4.5	14.2
604.6884	1/17/2019	2.562	2.88	10.1	18.2	10.1	18.2
236.7951	1/22/2019	2.657	2.88	1.886	8.8	1.886	8.8
318.2219	1/23/2019	2.895	2.88	2.68	10.5	2.68	10.5
365.3396	1/24/2019	2.743	2.88	2.77	13.2	2.77	13.2
304.1451	1/29/2019	2.491	2.88	3.64	11	3.64	11
336.3234	1/30/2019	2.497	2.88	2.75	13.4	2.75	13.4
355.0958	1/31/2019	2.487	2.88	3.02	14.1	3.02	14.1
223.8309	2/5/2019	2.652	2.93	1.52	8.6	1.52	8.6
210.9329	2/6/2019	2.547	2.93	1.23	8.7	1.23	8.7
428.9362	2/7/2019	2.426	2.93	10.3	10.9	10.3	10.9
226.6905	2/12/2019	2.657	2.93	1.83	8.4	1.83	8.4
268.1831	2/13/2019	3.125	2.93	1.39	8.9	1.39	8.9
328.7053	2/14/2019	3.326	2.93	2.15	9.7	2.15	9.7
264.0451	2/19/2019	3.393	2.93	0.531	8.8	0.531	8.8
542.6492	2/20/2019	3.335	2.93	5.71	13.8	5.71	13.8
679.5766	2/21/2019	3.134	2.93	9.9	16.1	9.9	16.1
431.9415	2/26/2019	2.895	2.93	2.79	15.1	2.79	15.1
337.8566	2/27/2019	2.719	2.93	0.599	14.3	0.599	14.3
351.5387	3/5/2019	2.506	2.68	4.52	12.3	4.52	12.3
439.4263	3/6/2019	2.509	2.68	6.4	14.6	6.4	14.6
350.2975	3/7/2019	2.655	2.68	1.62	14.2	1.62	14.2
660.2638	3/12/2019	3.528	2.68	6.74	15.7	6.74	15.7
440.9361	3/13/2019	3.126	2.68	0.613	16.3	0.613	16.3
422.129	3/14/2019	2.952	2.68	0.946	16.2	0.946	16.2
352.4667	3/19/2019	2.658	2.68	2.2	13.7	2.2	13.7
406.9578	3/20/2019	2.615	2.68	1.86	16.8	1.86	16.8
275.6121	3/21/2019	2.618	2.68	0.323	12.3	0.323	12.3

441.3161	3/26/2019	2.515	2.68	2.64	18.4	2.64	18.4
305.271	3/27/2019	2.451	2.68	0.134	14.8	0.134	14.8
288.459	3/28/2019	2.47	2.68	0.103	13.9	0.103	13.9
272.4384	4/2/2019	2.339	2.76	0.766	13.2	0.766	13.2
340.4759	4/3/2019	2.313	2.76	1.15	16.5	1.15	16.5
369.7872	4/4/2019	2.278	2.76	0.264	19.2	0.264	19.2
346.6341	4/9/2019	2.553	2.76	0.28	16	0.28	16
457.8269	4/11/2019	2.815	2.76	0.301	19.2	0.301	19.2
387.6895	4/16/2019	3.091	2.76	0.139	14.9	0.139	14.9
443.8649	4/17/2019	2.943	2.76	0.084	18	0.084	18
438.3442	4/18/2019	2.987	2.76	0.196	17.4	0.196	17.4
331.4237	4/23/2019	2.828	2.76	0.252	13.8	0.252	13.8
485.4382	4/24/2019	2.765	2.76	0.251	20.8	0.251	20.8
453.875	4/25/2019	2.639	2.76	0.022	20.6	0.022	20.6
432.8662	4/30/2019	2.507	2.76	0.403	20.3	0.403	20.3
590.375	5/1/2019	2.525	2.47	0.335	27.7	0.335	27.7
577.977	5/2/2019	2.449	2.47	0.198	28.1	0.198	28.1
487.3825	5/7/2019	2.471	2.47	1.65	22	1.65	22
594.3931	5/8/2019	2.586	2.47	2.36	25.2	2.36	25.2
526.2206	5/9/2019	2.4	2.47	1.19	25.1	1.19	25.1
323.0376	5/14/2019	2.296	2.47	6.17	10.7	6.17	10.7
421.7558	5/15/2019	2.324	2.47	8.56	13.2	8.56	13.2
590.8823	5/16/2019	2.567	2.47	10.4	17.2	10.4	17.2
703.5908	5/21/2019	2.474	2.47	15.7	18.4	15.7	18.4
440.6989	5/22/2019	2.359	2.47	2.3	20.1	2.3	20.1
323.6912	5/23/2019	2.405	2.47	0.338	15.8	0.338	15.8
252.7796	5/28/2019	2.423	2.47	0.109	12.4	0.109	12.4
462.2255	5/29/2019	2.448	2.47	2.84	19.8	2.84	19.8
413.1922	5/30/2019	2.325	2.47	0.109	21.2	0.109	21.2
509.8989	6/4/2019	2.32	2.35	0.753	25.6	0.753	25.6
534.2829	6/5/2019	2.326	2.35	0.342	27.2	0.342	27.2
586.1485	6/6/2019	2.4	2.35	0.284	29	0.284	29
516.9911	6/11/2019	2.381	2.35	0.335	25.7	0.335	25.7
510.8707	6/12/2019	2.439	2.35	0.115	25	0.115	25
431.6451	6/13/2019	2.297	2.35	0.032	22.5	0.032	22.5
337.0054	6/18/2019	2.315	2.35	0.155	17.3	0.155	17.3
534.7637	6/19/2019	2.319	2.35	0.05	27.6	0.05	27.6
470.5536	6/20/2019	2.21	2.35	0.03	25.5	0.03	25.5
396.2744	6/25/2019	2.335	2.35	0.049	20.3	0.049	20.3
503.641	6/26/2019	2.256	2.35	0.068	26.7	0.068	26.7
468.5209	6/27/2019	2.226	2.35	0.037	25.2	0.037	25.2
304.8395	6/30/2019	2.353	2.35	0.034	15.5	0.034	15.5
243.1117	7/1/2019	2.154	2.17	0.033	13.5	0.033	13.5
308.5204	7/2/2019	2.771	2.17	1.35	12	1.35	12
219.0567	7/9/2019	2.157	2.17	0.977	11.2	0.977	11.2

203.684	7/10/2019	2.18	2.17	0.803	10.4	0.803	10.4
225.8778	7/11/2019	2.166	2.17	0.904	11.6	0.904	11.6
223.4133	7/14/2019	2.253	2.17	3.29	8.6	3.29	8.6
226.379	7/16/2019	2.114	2.17	2.74	10.1	2.74	10.1
259.1459	7/17/2019	2.121	2.17	4.75	9.9	4.75	9.9
213.0812	7/23/2019	2.147	2.17	2.2	9.7	2.2	9.7
245.2961	7/24/2019	2.15	2.17	4.18	9.5	4.18	9.5
227.8418	7/25/2019	2.141	2.17	2.96	9.8	2.96	9.8
229.8367	7/30/2019	2.133	2.17	1.72	11.2	1.72	11.2
226.2151	7/31/2019	2.151	2.17	1.71	10.9	1.71	10.9
207.5549	8/1/2019	2.067	2.12	1.34	10.7	1.34	10.7
218.2307	8/6/2019	2.085	2.12	1.25	11.3	1.25	11.3
225.2698	8/7/2019	2.089	2.12	1.53	11.4	1.53	11.4
224.5729	8/8/2019	2.089	2.12	1.59	11.3	1.59	11.3
240.1776	8/15/2019	2.076	2.12	0.972	12.9	0.972	12.9
196.4682	8/20/2019	2.077	2.12	0.542	10.8	0.542	10.8
242.2679	8/21/2019	2.147	2.12	1.63	11.9	1.63	11.9
238.9223	8/22/2019	2.123	2.12	0.894	12.6	0.894	12.6
225.9653	8/25/2019	2.273	2.12	1.22	10.7	1.22	10.7
217.5873	8/27/2019	2.104	2.12	0.7	11.7	0.7	11.7
231.0123	8/28/2019	2.134	2.12	0.88	12.1	0.88	12.1
235.8525	9/2/2019	2.288	2.441	3.76	8.6	3.76	8.6
204.5775	9/3/2019	2.198	2.441	1.26	9.9	1.26	9.9
230.4809	9/10/2019	2.36	2.441	1.11	10.6	1.11	10.6
243.739	9/11/2019	2.277	2.441	0.535	12.3	0.535	12.3
269.779	9/12/2019	2.278	2.441	1.4	12.8	1.4	12.8
293.9557	9/17/2019	2.548	2.441	0.633	13.2	0.633	13.2
374.4793	9/18/2019	2.544	2.441	2.55	15.1	2.55	15.1
275.9354	9/19/2019	2.401	2.441	2.28	11.5	2.28	11.5
284.3816	9/24/2019	2.576	2.441	0.037	13.2	0.037	13.2
436.1943	9/25/2019	2.473	2.441	0.049	21.1	0.049	21.1
501.6757	9/26/2019	2.666	2.441	0.063	22.5	0.063	22.5
360.4928	9/30/2019	2.561	2.441	0.278	16.6	0.278	16.6
394.4318	10/1/2019	2.391	2.58	1.08	18.7	1.08	18.7
340.256	10/2/2019	2.361	2.58	3.38	13.9	3.38	13.9
268.7558	10/6/2019	2.571	2.58	0.734	11.8	0.734	11.8
265.9543	10/7/2019	2.75	2.58	0.196	11.4	0.196	11.4
499.0094	10/22/2019	3.385	2.58	0.076	17.6	0.076	17.6
458.9887	10/23/2019	2.938	2.58	0.032	18.7	0.032	18.7
403.5586	10/24/2019	2.76	2.58	0.032	17.5	0.032	17.5
301.4382	10/29/2019	2.332	2.58	0.199	15.3	0.199	15.3
377.0299	10/30/2019	2.346	2.58	1.07	18.2	1.07	18.2
362.441	10/31/2019	2.269	2.58	0.153	19	0.153	19
286.725	11/5/2019	2.232	2.52	0.303	15.1	0.303	15.1
347.6173	11/6/2019	2.282	2.52	0.065	18.2	0.065	18.2

308.3958	11/7/2019	2.264	2.52	0.033	16.3	0.033	16.3
301.7105	11/12/2019	2.301	2.52	0.022	15.7	0.022	15.7
401.9089	11/13/2019	2.254	2.52	1.48	19.9	1.48	19.9
333.3875	11/14/2019	2.281	2.52	0.025	17.5	0.025	17.5
403.6107	11/19/2019	3.019	2.52	0.03	16	0.03	16
358.9806	11/20/2019	2.829	2.52	0.015	15.2	0.015	15.2
360.0025	11/21/2019	2.598	2.52	0.015	16.6	0.015	16.6
273.4094	11/24/2019	2.881	2.52	0.079	11.3	0.079	11.3
250.5752	11/25/2019	2.679	2.52	0.015	11.2	0.015	11.2
302.1104	11/26/2019	2.607	2.52	0.095	13.8	0.095	13.8
279.2958	12/3/2019	2.311	2.94	0.091	14.4	0.091	14.4
279.555	12/4/2019	2.423	2.94	0.034	13.8	0.034	13.8
321.6192	12/5/2019	2.351	2.94	0.103	16.3	0.103	16.3
379.3479	12/10/2019	2.564	2.94	0.24	17.5	0.24	17.5
400.9158	12/11/2019	2.566	2.94	0.034	18.7	0.034	18.7
421.6414	12/12/2019	2.884	2.94	0.03	17.5	0.03	17.5
345.3212	12/16/2019	2.716	2.94	0.445	14.8	0.445	14.8
394.669	12/17/2019	2.595	2.94	0.136	18.1	0.136	18.1
390.666	12/18/2019	2.553	2.94	0.148	18.2	0.148	18.2
470.6262	12/22/2019	4.125	2.94	0.08	13.6	0.08	13.6
274.1829	12/25/2019	2.983	2.94	0.321	10.7	0.321	10.7
360.4794	12/26/2019	2.853	2.94	2.25	12.9	2.25	12.9
296.2197	12/30/2019	2.65	2.94	0.503	12.9	0.503	12.9
299.3096	12/31/2019	2.833	2.94	0.568	12.1	0.568	12.1
225.1343	1/2/2020	2.947	3.42	0.06	9.1	0.06	9.1
473.3853	1/7/2020	3.531	3.42	0.175	15.9	0.175	15.9
527.2238	1/8/2020	3.607	3.42	0.126	17.4	0.126	17.4
591.2864	1/9/2020	3.449	3.42	0.156	20.4	0.156	20.4
486.7552	1/14/2020	3.341	3.42	0.169	17.3	0.169	17.3
451.8508	1/15/2020	3.228	3.42	0.084	16.7	0.084	16.7
430.3984	1/16/2020	3.201	3.42	0.022	16.1	0.022	16.1
464.0625	1/21/2020	3.271	3.42	0.111	16.9	0.111	16.9
572.7686	1/22/2020	3.545	3.42	0.073	19.3	0.073	19.3
671.5293	1/23/2020	3.676	3.42	0.904	21	0.904	21
495.3985	1/28/2020	3.681	3.42	0.037	16.1	0.037	16.1
446.2546	1/29/2020	3.445	3.42	0.032	15.5	0.032	15.5
462.267	1/30/2020	3.335	3.42	0.02	16.6	0.02	16.6
432.698	2/3/2020	3.401	3.64	0.255	15	0.255	15
515.0403	2/4/2020	3.874	3.64	0.041	15.9	0.041	15.9
650.6581	2/6/2020	6.699	3.64	0.046	11.6	0.046	11.6
475.0851	2/11/2020	3.512	3.64	0.12	16.1	0.12	16.1
467.8927	2/12/2020	3.261	3.64	0.204	17	0.204	17
530.7572	2/13/2020	3.35	3.64	0.097	18.9	0.097	18.9
339.8397	2/18/2020	3.04	3.64	0.104	13.3	0.104	13.3
454.5345	2/19/2020	2.972	3.64	0.538	17.8	0.538	17.8

510.8283	2/20/2020	2.82	3.64	0.52	21.2	0.52	21.2
287.6027	2/25/2020	2.759	3.64	0.399	12.1	0.399	12.1
317.1885	2/26/2020	2.7	3.64	0.186	13.9	0.186	13.9
364.0745	2/27/2020	2.651	3.64	0.867	15.6	0.867	15.6
359.5012	3/3/2020	3.17	2.83	0.098	13.5	0.098	13.5
358.4385	3/4/2020	3.062	2.83	0.036	14	0.036	14
409.3544	3/5/2020	3.288	2.83	0.028	14.9	0.028	14.9
369.8903	3/10/2020	2.944	2.83	0.165	14.9	0.165	14.9
295.6656	3/11/2020	2.865	2.83	0.074	12.3	0.074	12.3
290.0877	3/12/2020	2.808	2.83	0.087	12.3	0.087	12.3
325.9526	3/17/2020	2.616	2.83	1.14	13.8	1.14	13.8
293.975	3/18/2020	2.626	2.83	0.723	12.7	0.723	12.7
269.3644	3/19/2020	2.594	2.83	0.251	12.2	0.251	12.2
364.579	3/24/2020	2.605	2.83	0.981	15.8	0.981	15.8
316.547	3/25/2020	2.614	2.83	1.02	13.5	1.02	13.5
294.4469	3/26/2020	2.546	2.83	0.567	13.3	0.567	13.3
365.4234	3/31/2020	2.825	2.83	1.11	14.4	1.11	14.4
325.0226	4/1/2020	2.741	2.6	0.518	13.7	0.518	13.7
311.8634	4/2/2020	2.715	2.6	0.573	13.2	0.573	13.2
382.5749	4/7/2020	2.567	2.6	3.07	14.8	3.07	14.8
398.2644	4/8/2020	2.532	2.6	2.06	16.8	2.06	16.8
401.3771	4/9/2020	2.575	2.6	3.69	15	3.69	15
328.8782	4/14/2020	2.477	2.6	2.22	13.7	2.22	13.7
354.7476	4/15/2020	2.508	2.6	2.36	14.6	2.36	14.6
391.867	4/16/2020	2.555	2.6	1.49	16.9	1.49	16.9
361.2888	4/21/2020	2.375	2.6	2.84	15.4	2.84	15.4
364.9567	4/22/2020	2.898	2.6	1.3	13.8	1.3	13.8
322.921	4/23/2020	2.791	2.6	0.473	13.4	0.473	13.4
376.2781	4/28/2020	2.587	2.6	1.34	16.1	1.34	16.1
400.8136	4/29/2020	2.507	2.6	4.17	15	4.17	15
389.978	4/30/2020	2.565	2.6	1.53	16.7	1.53	16.7
308.2179	5/5/2020	2.715	2.72	0.312	13.3	0.312	13.3
317.7327	5/6/2020	2.869	2.72	0.179	13.1	0.179	13.1
306.8097	5/7/2020	2.702	2.72	0.315	13.3	0.315	13.3
400.7328	5/12/2020	3.11	2.72	7.85	7.6	7.85	7.6
472.8705	5/13/2020	2.589	2.72	15.1	6.8	15.1	6.8
471.7671	5/14/2020	2.481	2.72	15.1	7.7	15.1	7.7
409.8867	5/19/2020	2.599	2.72	9.01	9.9	9.01	9.9
465.5997	5/20/2020	2.621	2.72	11.9	9.4	11.9	9.4
555.2288	5/21/2020	2.541	2.72	18.5	7.7	18.5	7.7
449.2041	5/26/2020	2.602	2.72	12.5	8.2	12.5	8.2
509.162	5/27/2020	2.609	2.72	13.5	9.9	13.5	9.9
521.8171	5/28/2020	2.64	2.72	13.3	10.4	13.3	10.4
605.901	6/2/2020	2.906	3.035	15.1	9.9	15.1	9.9
602.8727	6/3/2020	2.791	3.035	15.3	10.6	15.3	10.6

411.641	6/4/2020	2.624	3.035	7.31	11.5	7.31	11.5
639.6713	6/9/2020	3.306	3.035	12.9	10.3	12.9	10.3
448.0406	6/10/2020	2.955	3.035	7.78	10.4	7.78	10.4
602.6217	6/11/2020	3.036	3.035	12.8	11	12.8	11
474.4157	6/16/2020	3.689	3.035	6.52	8.9	6.52	8.9
520.2859	6/17/2020	3.354	3.035	9	9.6	9	9.6
488.2831	6/18/2020	3.163	3.035	8.01	10.5	8.01	10.5
321.9514	6/23/2020	2.868	3.035	2.66	10.8	2.66	10.8
233.5526	6/24/2020	2.859	3.035	0.495	9.3	0.495	9.3
228.6359	6/25/2020	2.753	3.035	0.158	9.8	0.158	9.8
253.6305	6/29/2020	2.572	3.035	0.024	11.8	0.024	11.8
308.0378	6/30/2020	2.571	3.035	0.166	14.2	0.166	14.2
377.0333	7/1/2020	2.649	2.45	0.066	17	0.066	17
399.5271	7/7/2020	2.579	2.45	0.075	18.5	0.075	18.5
364.833	7/8/2020	2.502	2.45	0.084	17.4	0.084	17.4
270.7291	7/9/2020	2.471	2.45	0.037	13.1	0.037	13.1
406.0729	7/14/2020	2.74	2.45	3.37	14.4	3.37	14.4
322.8319	7/15/2020	2.424	2.45	0.469	15.5	0.469	15.5
272.5713	7/16/2020	2.401	2.45	0.512	13.1	0.512	13.1
353.5366	7/21/2020	2.455	2.45	0.367	16.9	0.367	16.9
241.0969	7/22/2020	2.375	2.45	0.272	11.9	0.272	11.9
292.5198	7/23/2020	2.333	2.45	0.034	15	0.034	15
307.4391	7/28/2020	2.36	2.45	0.02	15.6	0.02	15.6
366.9522	7/29/2020	2.363	2.45	0.02	18.6	0.02	18.6
316.9285	7/30/2020	2.301	2.45	0.015	16.5	0.015	16.5
311.5149	8/11/2020	2.289	2.295	0.018	16.3	0.018	16.3
353.2698	8/12/2020	2.282	2.295	0.062	18.5	0.062	18.5
280.7905	8/13/2020	2.288	2.295	0.015	14.7	0.015	14.7
297.6251	8/18/2020	2.311	2.295	0.042	15.4	0.042	15.4
348.0862	8/19/2020	2.304	2.295	0.015	18.1	0.015	18.1
259.7369	8/20/2020	2.254	2.295	0.017	13.8	0.017	13.8
301.8338	8/25/2020	2.218	2.295	0.017	16.3	0.017	16.3
281.6131	8/26/2020	2.148	2.295	0.02	15.7	0.02	15.7
318.5832	8/27/2020	2.205	2.295	0.024	17.3	0.024	17.3
260.8882	9/15/2020	2.346	2.37	0.134	13.2	0.134	13.2
316.6846	9/16/2020	2.31	2.37	0.038	16.4	0.038	16.4
276.1888	9/17/2020	2.31	2.37	0.036	14.3	0.036	14.3
309.7876	9/22/2020	2.345	2.37	0.04	15.8	0.04	15.8
374.6401	9/23/2020	2.575	2.37	0.045	17.4	0.045	17.4
306.4746	9/24/2020	2.45	2.37	0.099	14.9	0.099	14.9
183.344	9/28/2020	2.486	2.37	0.043	8.8	0.043	8.8
232.9141	9/29/2020	2.419	2.37	0.045	11.5	0.045	11.5
197.1733	9/30/2020	2.398	2.37	0.059	9.8	0.059	9.8
199.7735	10/6/2020	2.374	2.68	0.29	9.8	0.29	9.8
165.6971	10/7/2020	2.354	2.68	0.24	8.2	0.24	8.2

186.3289	10/8/2020	2.32	2.68	0.53	9.1	0.53	9.1
274.7796	10/11/2020	2.88	2.68	0.04	11.4	0.04	11.4
260.0321	10/12/2020	2.724	2.68	0.046	11.4	0.046	11.4
337.3625	10/27/2020	2.568	2.68	0.052	15.7	0.052	15.7
358.1954	10/28/2020	2.548	2.68	0.056	16.8	0.056	16.8
269.2454	10/29/2020	2.51	2.68	0.062	12.8	0.062	12.8
359.389	11/3/2020	2.883	3.05	0.147	14.8	0.147	14.8
337.7727	11/4/2020	2.924	3.05	0.051	13.8	0.051	13.8
296.9462	11/5/2020	2.981	3.05	0.044	11.9	0.044	11.9
411.4354	11/8/2020	2.731	3.05	0.064	18	0.064	18
444.3234	11/11/2020	2.755	3.05	0.038	19.3	0.038	19.3
376.4131	11/12/2020	2.713	3.05	0.036	16.6	0.036	16.6
313.537	12/8/2020	2.883	3.05	0.14	12.9	0.14	12.9

ATTACHMENT C

REVISED PERMIT ACTION LEVEL ALTERNATIVE 2

Data, Controls, Numeric Output

significant digits to display

3

366 Daily

Fix Random number Seed

134,000 Annual

Action Level based on 109 data points Over 1800 days

Please select Data file

Browse... WA0020893DAYmp002_DMR(alt2).csv

Upload complete

Earliest Data to consider for calculation

2014-01-01

Latest Data to consider for calculation

2021-03-11

Samples per month (per year/12)

1 4 30

1 4 7 10 13 16 19 22 25 28 30

Thousands of iterations

4 48 100

4 14 24 34 44 54 64 74 84 94 100

Confidence Level Needed

90 99

90 91 92 93 94 95 96 97 98 99

If Date is not second field input, data assumed to be sequential months starting in Jan 2015

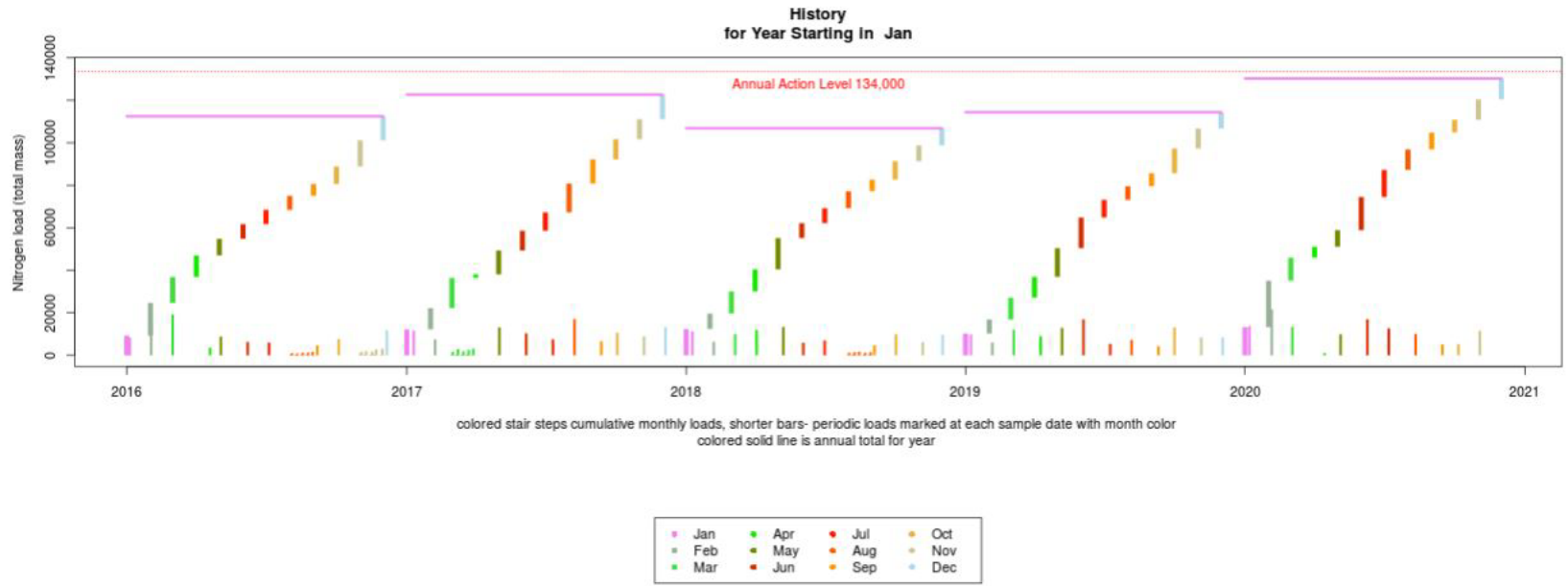
WA0020893DAYmp002_DMR(alt2).csv

DataTable Summary Individual Annual Version Help

first month of year

Jan

Extrapolate data to ends of year



load	POS	Q2	Qave	AMM	NIT	Ammonia	Nitrate...Nitrite
297.7915	1/5/2016	2.511	3.12294	0.02	14.2	0.02	14.2
540.1278	2/2/2016	2.848	2.97866	0.04	22.7	0.04	22.7
392.5671	3/1/2016	2.92	3.07742	0.02	16.1	0.02	16.1
256.8628	4/19/2016	2.295	2.43637	0.02	13.4	0.02	13.4
252.4835	5/3/2016	2.29	2.22839	0.02	13.2	0.02	13.2
224.8998	6/7/2016	2.12	2.1628	0.02	12.7	0.02	12.7
214.6773	7/5/2016	2.254	2.09394	0.02	11.4	0.02	11.4
187.8929	8/2/2016	2.026	2.05555	0.02	11.1	0.02	11.1
241.3519	8/3/2016	2.073	2.05555	0.06	13.9	0.06	13.9
202.234	8/4/2016	2.069	2.05555	0.02	11.7	0.02	11.7
221.8307	8/9/2016	2.078	2.05555	0.4	12.4	0.4	12.4
221.0961	8/10/2016	2.033	2.05555	0.04	13	0.04	13
157.1263	8/11/2016	1.979	2.05555	0.02	9.5	0.02	9.5
167.1816	8/16/2016	2.128	2.05555	0.02	9.4	0.02	9.4
203.7399	8/17/2016	2.046	2.05555	0.14	11.8	0.14	11.8
248.2244	8/18/2016	2.033	2.05555	0.24	14.4	0.24	14.4
173.1119	8/23/2016	2.031	2.05555	0.02	10.2	0.02	10.2
213.3894	8/24/2016	2.042	2.05555	0.03	12.5	0.03	12.5
254.9905	8/25/2016	1.97	2.05555	0.02	15.5	0.02	15.5
205.0439	8/30/2016	2.08	2.05555	0.02	11.8	0.02	11.8
275.0138	8/31/2016	2.028	2.05555	0.16	16.1	0.16	16.1
166.9885	9/6/2016	2.21	2.2469	0.02	9.04	0.02	9.04
274.7339	10/4/2016	2.401	2.80587	0.02	13.7	0.02	13.7
418.8628	11/1/2016	3.608	3.4292	0.02	13.9	0.02	13.9
414.3465	11/3/2016	3.082	3.4292	0.02	16.1	0.02	16.1
337.0239	11/7/2016	2.967	3.4292	0.02	13.6	0.02	13.6
354.814	11/8/2016	2.777	3.4292	0.02	15.3	0.02	15.3
323.9503	11/9/2016	2.873	3.4292	0.02	13.5	0.02	13.5
456.4727	11/15/2016	4.337	3.4292	0.02	12.6	0.02	12.6
537.7098	11/16/2016	3.68	3.4292	0.02	17.5	0.02	17.5
576.9969	11/17/2016	3.242	3.4292	0.04	21.3	0.04	21.3
401.1552	11/20/2016	3.366	3.4292	0.09	14.2	0.09	14.2
369.1162	11/21/2016	3.019	3.4292	0.06	14.6	0.06	14.6
391.6544	11/22/2016	3.232	3.4292	0.03	14.5	0.03	14.5
433.6627	11/29/2016	3.846	3.4292	0.02	13.5	0.02	13.5
516.5404	11/30/2016	3.915	3.4292	0.02	15.8	0.02	15.8
337.9131	12/6/2016	3.343	3.18406	0.02	12.1	0.02	12.1
417.5748	1/10/2017	2.742	2.83858	0.66	17.6	0.66	17.6
338.3998	2/7/2017	2.936	3.23468	0.02	13.8	0.02	13.8
473.7123	3/1/2017	3.092	3.55358	0.47	17.9	0.47	17.9
340.1004	3/2/2017	3.014	3.55358	0.03	13.5	0.03	13.5
480.41	3/7/2017	3.702	3.55358	0.46	15.1	0.46	15.1
530.6627	3/8/2017	3.498	3.55358	0.39	17.8	0.39	17.8
588.8736	3/9/2017	3.586	3.55358	0.19	19.5	0.19	19.5

348.3535	3/14/2017	3.825	3.55358	0.02	10.9	0.02	10.9
414.1466	3/15/2017	4.379	3.55358	0.04	11.3	0.04	11.3
387.1395	3/16/2017	3.83	3.55358	0.02	12.1	0.02	12.1
440.5084	3/21/2017	3.375	3.55358	0.15	15.5	0.15	15.5
469.8085	3/22/2017	3.188	3.55358	0.77	16.9	0.77	16.9
523.2519	3/23/2017	3.077	3.55358	0.49	19.9	0.49	19.9
286.2185	3/28/2017	3.358	3.55358	0.02	10.2	0.02	10.2
529.6879	3/29/2017	4.002	3.55358	0.17	15.7	0.17	15.7
1.299789	4/4/2017	3.117	3.26913	0.04	0.01	0.04	0.01
375.9532	5/2/2017	2.828	2.92835	0.04	15.9	0.04	15.9
296.5849	6/6/2017	2.473	2.41167	0.08	14.3	0.08	14.3
268.4092	7/11/2017	2.453	2.21252	0.02	13.1	0.02	13.1
488.1502	8/8/2017	2.08	2.08839	1.84	26.3	1.84	26.3
317.5288	9/12/2017	2.058	2.09257	0.1	18.4	0.1	18.4
303.6978	10/3/2017	2.055	2.291	0.02	17.7	0.02	17.7
317.7633	11/7/2017	2.368	2.999	1.19	14.9	1.19	14.9
380.3749	12/5/2017	2.905	3.134	0.1	15.6	0.1	15.6
405.1618	1/9/2018	4.357	3.624	0.75	10.4	0.75	10.4
228.4586	2/6/2018	4.476	3.74	0.02	6.1	0.02	6.1
358.1108	3/6/2018	2.838	3.08394	1.43	13.7	1.43	13.7
343.4712	4/3/2018	2.98	3.5245	0.12	13.7	0.12	13.7
515.0542	5/8/2018	2.67	2.55	0.13	23	0.13	23
212.474	6/3/2018	2.51	2.47	0.05	10.1	0.05	10.1
226.1618	7/1/2018	2.532	2.2261	0.41	10.3	0.41	10.3
204.3296	8/1/2018	2.177	2.15	0.454	10.8	0.454	10.8
257.9629	8/2/2018	2.12	2.15	1.69	12.9	1.69	12.9
230.2113	8/7/2018	2.156	2.15	0.303	12.5	0.303	12.5
331.1407	8/8/2018	2.121	2.15	4.22	14.5	4.22	14.5
288.8736	8/9/2018	2.209	2.15	1.48	14.2	1.48	14.2
140.7647	8/14/2018	2.017	2.15	0.268	8.1	0.268	8.1
281.3332	8/15/2018	2.212	2.15	4.15	11.1	4.15	11.1
280.6418	8/21/2018	2.178	2.15	3.05	12.4	3.05	12.4
225.3171	8/22/2018	2.134	2.15	1.46	11.2	1.46	11.2
238.2084	8/23/2018	2.046	2.15	1.96	12	1.96	12
201.9661	8/28/2018	2.168	2.15	1.07	10.1	1.07	10.1
192.4609	8/29/2018	2.05	2.15	0.857	10.4	0.857	10.4
285.5566	8/30/2018	2.026	2.15	5.6	11.3	5.6	11.3
171.2169	9/4/2018	2.184	2.37	0.37	9.03	0.37	9.03
284.6178	10/2/2018	2.564	2.46	4.66	8.65	4.66	8.65
238.7358	11/6/2018	3.078	2.954	0.36	8.94	0.36	8.94
261.2013	12/2/2018	3.026	2.94	1.53	8.82	1.53	8.82
351.5373	1/8/2019	3.225	2.88	1.27	11.8	1.27	11.8
215.8686	2/5/2019	2.652	2.93	1.52	8.24	1.52	8.24
347.3587	3/5/2019	2.506	2.68	4.52	12.1	4.52	12.1
321.0837	4/9/2019	2.553	2.76	0.28	14.8	0.28	14.8

460.5919	5/7/2019	2.471	2.47	1.65	20.7	1.65	20.7
483.9135	6/4/2019	2.32	2.35	1.01	24	1.01	24
193.9255	7/9/2019	2.157	2.17	0.98	9.8	0.98	9.8
207.7974	8/6/2019	2.085	2.12	1.25	10.7	1.25	10.7
204.1065	9/10/2019	2.36	2.441	1.11	9.26	1.11	9.26
374.4909	10/1/2019	2.391	2.58	1.08	17.7	1.08	17.7
303.4225	11/5/2019	2.232	2.52	0.3	16	0.3	16
242.6564	12/3/2019	2.311	2.94	0.09	12.5	0.09	12.5
472.0601	1/7/2020	3.531	3.42	0.13	15.9	0.13	15.9
797.7063	2/5/2020	6.911	3.64	0.04	13.8	0.04	13.8
319.8974	3/3/2020	3.17	2.83	0.1	12	0.1	12
53.50469	4/14/2020	2.477	2.6	2.22	0.37	2.22	0.37
283.2652	5/5/2020	2.715	2.72	0.31	12.2	0.31	12.2
606.3092	6/9/2020	3.306	3.035	12.9	9.09	12.9	9.09
363.0696	7/7/2020	2.579	2.45	0.08	16.8	0.08	16.8
286.7357	8/11/2020	2.289	2.295	0.02	15	0.02	15
243.2009	9/15/2020	2.346	2.37	0.13	12.3	0.13	12.3
185.1221	10/6/2020	2.374	2.68	0.29	9.06	0.29	9.06
330.608	11/3/2020	2.883	3.05	0.15	13.6	0.15	13.6
313.537	12/8/2020	2.883	3.05	0.14	12.9	0.14	12.9

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August 16, 2021

Eleanor Ott, PSNGP Permit Writer
Department of Ecology
Water Quality Program
PO BOX 47600
Olympia, WA 98504-7600

RE: Draft Nutrient General Permit Comments

To whom it may concern:

The Lake Stevens Sewer District (permit WA0020893) appreciates the opportunity to comment on the Draft Puget Sound Nutrient General Permit (PSNGP) dated July 16, 2021. The District takes its mission very seriously, which is: "Meeting the challenge of protecting the environment and providing quality sewer service to the community." To that end, the District shares Ecology's concern for nutrients' contribution to depleting dissolved oxygen levels in the Salish Sea and implementing reasonable effective solutions supported by sound scientific data.

The District owns and operates a moderately sized, 5.01 MGD maximum month design flow, publicly owned domestic wastewater treatment plant within the PSNGP Proposed Facility Coverage list, which has been identified as a dominant contributor of total inorganic nitrogen (TIN) discharged into Washington Waters of the Salish Sea. It is somewhat concerning that the PSNGP is being used to "determine the scale of reductions necessary to meet numeric water quality standards for DO" (PSNGP Fact Sheet p.30) while simultaneously imposing limits for TIN with associated penalties and forced engineering expenditures. If the general permit is to be used to collect the necessary data to complete modeling, it is the District's opinion is that these studies should be complete in order to establish long-term criteria to protect the receiving waters prior to imposing major changes to point sources.

The customer base served by the District treatment facility is also of moderate size. The District operates within the City of Lake Stevens, City of Marysville, and Snohomish County which are required to complete comprehensive plans under the Growth Management Act (GMA). As such, the District has been growing and is expected to grow to accommodate the expected increase in population. The District invested in a new approximately $120 million treatment plant facility, accepted by Ecology in 2013, that was expected to meet water quality requirements for 20-30 years, with phased capacity upgrades as population increased. There is a real possibility and high concern from the District that the changes needed to reduce the TIN to meet the PSNGP will affect the plant's capacity and reduce the District's ability to accommodate the increased growth in its service area. The comprehensive plan is central in the GMA planning for utilities to support growth. However, the PSNGP has an aggressive timeline that does not allow for vetted planning for necessary utility expansion in our area, nor for the adequate collection of funds through general facilities charges to support the capital improvements that will be required to meet the PSNGP requirements. RCW 57.08.005(11) indicates that a District connection charge be established based on a 10-year "look-ahead" to receive revenue based on future capital improvement projects (CIPs). Within the framework of the statute and comprehensive planning

guidelines, any capital expenditures not forecasted in the comprehensive plan are unfunded and impossible to recover funds from the previous planning period. Due to these limitations, it is easier to plan and minimize rate impacts with a longer implementation period and very difficult with shorter periods.

A static total yearly amount of inorganic nitrogen does not account for any growth that has occurred in the data utilized for setting the action level or going forward. For example, data from 2016 through 2020 was used to set Lake Stevens Sewer District's action level, but the District has grown by over 2,000 connections since 2016. The District is also expected to take growth of another approximately 10,000 people in its service area over the next ten years. In addition, the facility has exceeded the set TIN limit two of the five years used to set the parameter and is expected to exceed again in 2021. The expected process performance for a Modified Ludzak-Ettinger (MLE) treatment facility design, as ours, ranges from 8 to 10 mg/L for effluent total nitrogen. Hence, our facility will need to alter its designed processing at additional engineering and capital improvements to comply with a 3 mg/L TIN limit.

The data set used for calculating the TIN Action Level for the Lake Stevens Sewer District was incomplete. Upon detailed review of the nitrate and nitrite analysis data used, three data points were missing from the set used by ecology resulting in a skewed statistical sampling lower than expected. The November 2016, April 2017, and April 2020 results have since been updated on the respective DMR through the WQWebDMR portal for consideration in the TIN Action Level calculation.

The PSNGP required Environmental Justice (EJ) Review (S4.E.5. d) is an overly burdensome analysis for each district/municipality to perform separately. Ecology has suggested that publicly available data may be used for this study and that Ecology does not intend on setting rates, but that is unclear from the draft permit language and requiring this information implies some level of review and recommendation criteria that Ecology will be using that could affect rate structure. It would seem more effective to have a coordinated study covering all effected permittees than to have individual permittees perform an EJ Review.

The District is also generally concerned with the speed at which the General Nutrient Permit will be implemented. The demand for testing equipment, laboratory accreditation, engineering support, and any additional operator training will bring undue pressure on the District. For example, the District's laboratory is not currently accredited to test Total Organic Carbon, TKN, or Nitrate plus Nitrite Nitrogen in final effluent. In addition, we have not historically been testing total Ammonia, Nitrate plus Nitrite Nitrogen, or TKN in the influent. Some flexibility with testing methods and laboratory scope expansion would be appreciated.

The rate base would be challenged to take on additional significant capital improvements. It is a goal of the District to keep the rates within the generally accepted 2% of median household income. The District hopes that the Department of Ecology advocates and assist in making loans and grants available to assist in meeting these new requirements that could me attainable for Districts of moderate size to meet the challenges of this general permit.

The District also recognizes and accepts that there is a general order to ever increasing stringency in regulatory elements imposed to maintain water quality and is concerned with the possibility that additional regulatory requirements for the next element of concern has not been considered with the customer in mind. It has been suggested that some of the laboratory analysis for carbon required in the PSNGP may be a foreshadow of another regulation by

Ecology. The speed at which the PSNGP regulations will require implementation of optimization and capital improvements will require engineering. It would be ideal to combine, or at a minimum not interfere with, additional engineering costs to account for the next regulation on the horizon.

Overall, the District cares deeply about protecting our receiving waters and respectfully request that Ecology please consider that costs of treating wastewater have and are expected to increase in years to come. Wastewater treatment plant point-sources are easy targets for regulation, but at what cost? Each increase in maintenance and operations and capital improvements comes with corresponding pressure applied on ratepayers. The water quality improvements need to be carefully weighed against the associated costs so that our receiving waters are healthy, and our costs are appropriate.

In addition to the comments above, Gray & Osborne, Inc. Consulting Engineers prepared a Technical Memorandum (attached to this letter) in which the action level set for the District is challenged in both method of calculation and resulting limits. This assessment suggests increasing the District's TIN action level from 118,000 lbs/year to between 129,000 and 141,000 lbs/year.

Thank you for this opportunity to comment on the Draft Puget Sound Nutrient General Permit.

Sincerely,

Mariah Low
General Manager
Lake Stevens Sewer District

Attached: Gray & Osborne, Inc. Technical Memorandum

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

TO:	MARIAH LOW, GENERAL MANAGER JOHNATHAN DIX, ASSISTANT GENERAL MANAGER JAMES HEITZMAN, WWTP SUPERVISOR JEFF BAISCH, SENIOR WWTP OPERATOR
FROM:	JAY SWIFT, P.E. KOTA NISHIGUCHI, E.I.T.
DATE:	AUGUST 10, 2021
SUBJECT:	TOTAL INORGANIC NITROGEN ACTION LEVEL EVALUATION, JUNE 2021 DRAFT PUGET SOUND NUTRIENT GENERAL PERMIT LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON G&O #20408.07

The following memorandum notes findings from investigation into the total inorganic nitrogen (TIN) action level determination provided in the Draft Puget Sound Nutrient General Permit (Draft Permit) issued in June 2021. These analyses were done to assist with the evaluation of wastewater treatment capital and operating improvements in the Lake Stevens Sewer District General Sewer/Wastewater Facility Plan (G&O 20408.07), as well as to assist the District with the development of review comments to be submitted to Ecology regarding the Draft Permit.

SUMMARY

The Draft Permit and Fact Sheet indicate that the calculated action level (AL) is meant to represent predicted 99th percentile plant effluent TIN loads based on historical observations. Calculation of AL assumes that if a facility behaves over the course of the permit cycle in a manner similar to its historical record, it can be assumed that "there is only a 1% chance of exceeding AL by chance in any year."

District staff routinely analyze effluent ammonia and nitrate concentrations in house and record this data on their plant process data sheets, but do not submit this nitrate data on their monthly discharge monitoring reports (DMRs). Effluent nitrate/nitrite concentrations are also analyzed once a month at the Everett wastewater treatment plant (WWTP) laboratory and these data are reported on the District's DMRs.

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Calculations of annual effluent TIN load were separately determined using the more complete WWTP process data and show that annual loading has surpassed the proposed action levels for 3 of the past 4 years, as shown in Table 1. This would appear to conflict with the intent of the action level determination (1 percent chance of exceedance) as described in the Draft Permit.

TABLE 1

Historical Effluent TIN Loads and Proposed Action Levels

Year	Annual Effluent TIN Load (lb/yr) (1)
2017	136,891
2018	115,320
2019	129,513
2020 (2)	132,960
Draft Permit Proposed Action Limit	**Annual Effluent TIN Load (lb/yr)**
AL	118,000

(1) Annual averages of TIN loadings calculated from process data (507 data points) are summarized in Table 1. Annual averages for TIN loadings calculated from DMR data (109 data points) ranged from 106,500 to 129,100 lb/yr.

(2) December 2020 represented by one datum for nitrate, available from DMR.

Based on a review of the data and calculations, data-input assumptions appear to have misrepresented the distribution of historical loadings, which resulted in a lower proposed action level than appropriate. Two alternative approaches to data input, which rely on actual measurements and minimize assumptions in the data input, are shown herein and resulted in a higher range of action levels (AL between 129,000 and 141,000 lb/yr).

It is recommended that the higher AL (141,000 lb/yr) be applied because:

1. The derivation of this value more accurately captures the variability in the relevant data (more data points are used), particularly for nitrate concentrations, which are the primary cause of the variability.

2. The resulting AL of 141,000 lb/yr would appear to be more consistent with the stated intent of the action levels – that "there is only a 1% chance of exceeding AL by chance in any year." The use of a 129,000 lb/yr AL, which the WWTP has exceeded 3 out of the last 4 years, is not reasonably consistent with the stated intent of a 1 percent chance of exceedance.

DATA INPUT AND CALCULATIONS FOR DRAFT PERMIT PROPOSED ACTION LEVEL

The data used to calculate the AL in the Draft Permit uses data available through DMRs, ranging from January 2016 to November 2020. The action level calculator shared by the Washington State Department of Ecology (Ecology) requires inputs of daily effluent TIN load and the associated date. In general, all other data provided in the input file appears to be unused and is organized in the calculator to provide additional context.

Apparent Assumptions Made for Draft Permit Calculation

The data input file used for the Draft Permit action level calculation shows that input loads were calculated with *daily* flows and *daily* effluent ammonia concentrations; however, these were used in conjunction with *monthly* reported effluent nitrate (single-day composite measurement per month reported via DMR), illustrated as follows:

$$\begin{aligned} Daily\ TIN\ Load &= Daily\ TIN\ Conc. * Daily\ Flow * 8.34 \\ &= (Daily\ Ammonia\ Conc. + Monthly\ Reported\ Nitrate) * Daily\ Flow * 8.34 \end{aligned}$$

$$with\ concentrations\ noted\ in\ mg/L\ and\ flows\ in\ MGD$$

This approach to providing daily TIN load inputs implies an assumption that daily variations in flow and ammonia concentrations have greater impact on effluent TIN than variations in effluent nitrate. In the Draft Permit calculation, each monthly reported effluent nitrate concentration is used as an average representative value for the entire month. This assumption is a misrepresentation of historical effluent TIN. Based on plant data, it is rare for effluent ammonia concentrations to be greater than effluent nitrate concentrations. Additionally, nitrate concentrations are typically an order of magnitude greater than ammonia concentrations; starting from 2017, the average ammonia concentration was 1.22 mg/L while nitrate was 14.5 mg/L, meaning that effluent TIN is primarily comprised of nitrate. Consequently, variations in effluent nitrate loadings tend to be primarily responsible for variations in effluent TIN. The Draft Permit's calculation does not accurately reflect that daily variations in nitrate values have significant impact on daily TIN loads. (Note: Nitrite concentrations measured in Lake Stevens effluent have been less than 0.1 percent of nitrate concentrations, so nitrate concentrations are assumed to equal nitrate plus nitrite in these data.)

The above approach to estimating daily TIN load provides a set of data inputs that maximizes the use of available ammonia measurements despite the fact that effluent TIN is comprised primarily of nitrate, for which fewer data points are available in the DMR data set. The apparent assumption is that a larger data set with approximated TIN values is more representative than a smaller data set, consisting of more accurate representations

of the distribution of historical TIN loadings. Bootstrapping used to determine AL randomly resamples data points from the data input to create multiple simulated data sets, all consisting of a variety of combinations of data points from the original data input. Individual data points from the original data input are being used multiple times to holistically represent the data and create simulated observations. Because of the resampling of data used in bootstrapping, the benefit of bootstrapping is dependent on the accuracy of the original data input, not only the mean values but also the variability in the data. The Draft Permit data input had introduced approximated values, whose inaccuracies likely propagated through the simulated observations and reduced variability and narrowed confidence intervals.

Alternative Approaches to Data Input

Two alternative approaches are presented to data input: (1) maximize the use of plant process data, and (2) refine usage of DMR data.

<u>Alternative 1 – Maximize Use of Plant Process Data</u>

Based on a review of available data (DMRs and plant process data), the following changes were applied as an alternative approach to data input:

- Whenever available in plant process data, flow, ammonia, and nitrate concentrations measured for the same date were used to calculate daily effluent TIN loads.

- DMR nitrate data were only used when the lack of plant process data would result in missing a month of TIN load. The DMR nitrate data points were used in conjunction with the flow and ammonia concentration of the date for which nitrate was reported; this limits the quantity of approximated TIN loads in the data input. Notably, much of the input data for 2016 consists of this approach due to the limited nitrate data in 2016.

- Lastly, as a note, the Draft Permit calculation for AL included data input for November 2016 for which the reported nitrate concentration was 1.3 mg/L; plant process data shows that nitrate ranged from 12.6 to 21.3 mg/L during this period. This misinput of data likely had some influence on the Draft Permit AL determinations. As discussed above, November 2016 inputs have been replaced with TIN loads calculated with available plant process data.

Due to the inclusion of plant process data, the data input described above consists of 597 data points, compared to 476 data points used for the Draft Permit action level determination. For this alternative approach for data input, a large majority of data points consist of TIN loads calculated from plant process data that accurately represent flow, ammonia, and nitrate. Therefore, this alternative approach is believed to increase the quantity and quality of input data.

As shown on Figure 1, with these revised assumptions, Ecology's Action Level Calculator returns an AL of 141,000 lb/yr. Based on Figure 1, the action level appears plausible according to Ecology's intent (1 percent exceedance chance) for the action level; unlike the Draft Permit's proposed AL, the alternative AL has not been exceeded by the WWTP multiple times in recent history.

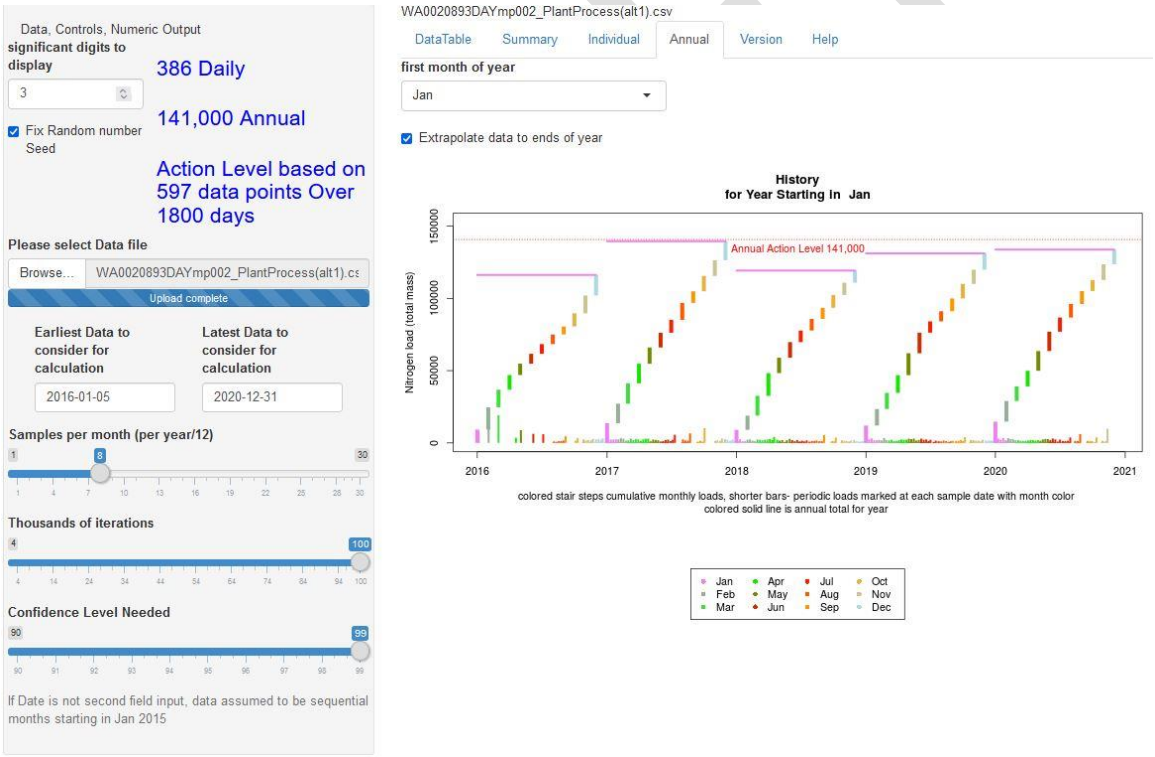


FIGURE 1

Revised Action Level (AL) Calculation, Alternative 1 – Screen Capture

Alternative 2 – Refine Usage of DMR Data

Another approach to data input consists of continuing the use of reported nitrate data but removing the data points that approximate TIN concentration based on assumptions of constant nitrate levels throughout the month. In turn, data used in the original Draft Permit calculation would be used without the assumptions that are believed to have perhaps misrepresented the historical distribution of TIN loadings. The following changes were applied to the original data input:

- Whenever available in DMR data, flow, ammonia, and nitrate concentrations measured for the same date were used to calculate daily effluent TIN loads.

- For any month of DMR data that did not allow for a calculation of daily effluent TIN (e.g., no ammonia measurement for corresponding nitrate measurement), plant process data was used to represent TIN loads for the month. Here, the use of plant process data followed its use for the first alternative approach. This method was applicable for data for August 2016 and August 2018.

- For the previously discussed reasons, November 2016 inputs have been replaced with TIN loads calculated with available plant process data.

The TIN action level calculation resulting from the revisions above is shown on Figure 2. The calculator returns an AL of 129,000 lb/yr.

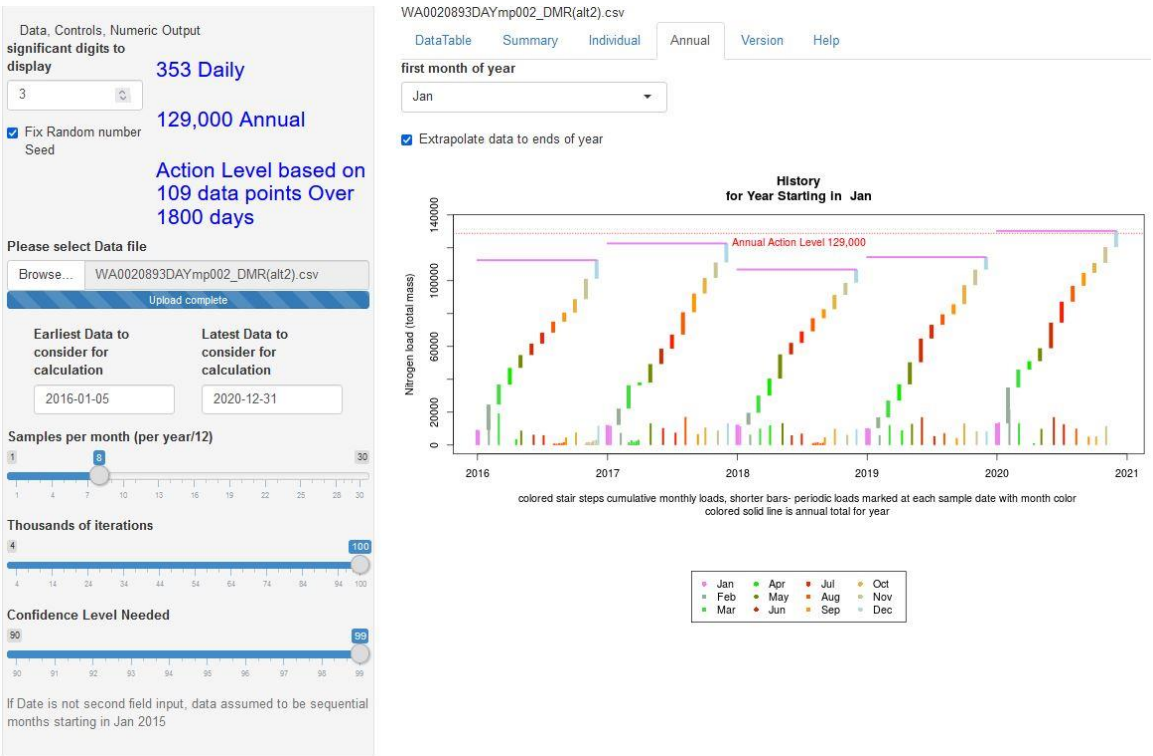


FIGURE 2

Revised Action Level (AL) Calculation, Alternative 2 – Screen Capture

DISCUSSION

The historical TIN loads calculated from plant process data, shown in Table 1, suggest that the AL of 129,000 lb/yr has been surpassed 3 of the past 4 years. Conversely, the historical TIN loads calculated from DMR data, shown on Figure 2, suggest that the AL was approached but not exceeded. Therefore, there is a discrepancy between historical observations made from plant process data and DMR data. However, both data sets result in higher action levels that better represent historical TIN loads than the proposed action level in the Draft Permit.

It is recommended that the higher AL (141,000 lb/yr) be applied because:

1. The derivation of this value more accurately captures the variability in the relevant data (more data points are used), particularly for nitrate concentrations, which are the primary cause of the variability.

2. The resulting AL of 141,000 lb/yr would appear to be more consistent with the stated intent of the action levels – that "there is only a 1% chance of exceeding AL by chance in any year." The use of a 129,000 lb/yr AL, which the WWTP has exceeded 3 out of the last 4 years, is not reasonably consistent with the stated intent of a 1 percent chance of exceedance.

ATTACHMENT A

DRAFT PERMIT ACTION LEVEL

Data, Controls, Numeric Output

significant digits to display

3

323 Daily

118,000 Annual

Fix Random number Seed

Action Level based on 476 data points Over 1760 days

Please select Data file

Browse... WA0020893DAYmp002.csv

Upload complete

Earliest Data to consider for calculation

2016-01-05

Latest Data to consider for calculation

2020-12-31

Samples per month (per year/12)

1 8 30

Thousands of iterations

4 100

Confidence Level Needed

90 99

If Date is not second field input, data assumed to be sequential months starting in Jan 2015

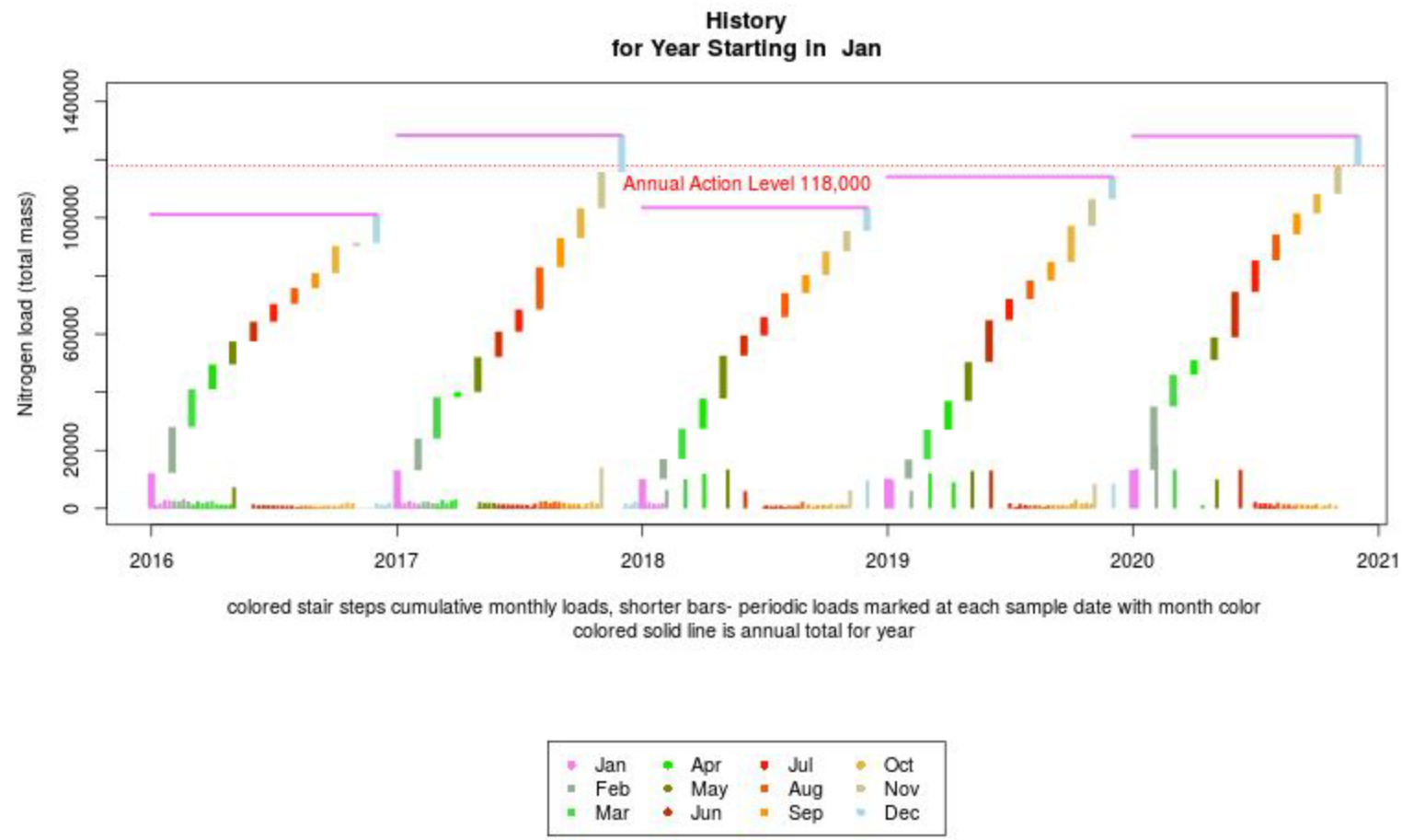
WA0020893DAYmp002.csv

DataTable | Summary | Individual | Annual | Version | Help

first month of year

Jan

Extrapolate data to ends of year



load	POS	Q2	Qave	AMM	NIT	Ammonia	Nitrate...Nitrite
297.7915428	1/5/2016	2.511	3.12294	0.02	14.2	0.02	14.2
294.321936	1/6/2016	2.48	3.12294	0.03	14.2	0.03	NA
285.1466016	1/7/2016	2.401	3.12294	0.04	14.2	0.04	NA
291.3959304	1/11/2016	2.372	3.12294	0.53	14.2	0.53	NA
375.6497796	1/13/2016	3.141	3.12294	0.14	14.2	0.14	NA
347.337648	1/14/2016	2.814	3.12294	0.6	14.2	0.6	NA
367.565484	1/19/2016	3.082	3.12294	0.1	14.2	0.1	NA
360.1724076	1/20/2016	3.037	3.12294	0.02	14.2	0.02	NA
577.66176	1/21/2016	4.81	3.12294	0.2	14.2	0.2	NA
389.583918	1/26/2016	3.285	3.12294	0.02	14.2	0.02	NA
403.9338888	1/27/2016	3.406	3.12294	0.02	14.2	0.02	NA
548.1451656	1/28/2016	4.622	3.12294	0.02	14.2	0.02	NA
540.1277568	2/2/2016	2.848	2.97866	0.04	22.7	0.04	22.7
539.0345496	2/3/2016	2.836	2.97866	0.09	22.7	0.09	NA
529.550385	2/4/2016	2.791	2.97866	0.05	22.7	0.05	NA
487.312038	2/9/2016	2.565	2.97866	0.08	22.7	0.08	NA
482.7523932	2/10/2016	2.541	2.97866	0.08	22.7	0.08	NA
492.0355638	2/11/2016	2.591	2.97866	0.07	22.7	0.07	NA
731.411328	2/16/2016	3.86	2.97866	0.02	22.7	0.02	NA
725.356905	2/17/2016	3.823	2.97866	0.05	22.7	0.05	NA
651.453246	2/18/2016	3.435	2.97866	0.04	22.7	0.04	NA
511.0405056	2/23/2016	2.697	2.97866	0.02	22.7	0.02	NA
490.765632	2/24/2016	2.59	2.97866	0.02	22.7	0.02	NA
482.2887726	2/25/2016	2.533	2.97866	0.13	22.7	0.13	NA
392.567136	3/1/2016	2.92	3.07742	0.02	16.1	0.02	16.1
379.6608192	3/2/2016	2.824	3.07742	0.02	16.1	0.02	NA
374.4147924	3/3/2016	2.761	3.07742	0.16	16.1	0.16	NA
446.8126644	3/7/2016	3.303	3.07742	0.12	16.1	0.12	NA
511.4128032	3/9/2016	3.804	3.07742	0.02	16.1	0.02	NA
493.7867136	3/10/2016	3.648	3.07742	0.13	16.1	0.13	NA
424.086498	3/15/2016	3.135	3.07742	0.12	16.1	0.12	NA
398.7514128	3/16/2016	2.966	3.07742	0.02	16.1	0.02	NA
376.7031216	3/17/2016	2.802	3.07742	0.02	16.1	0.02	NA
362.1391464	3/22/2016	2.692	3.07742	0.03	16.1	0.03	NA
387.7272672	3/23/2016	2.884	3.07742	0.02	16.1	0.02	NA
443.9235216	3/24/2016	3.302	3.07742	0.02	16.1	0.02	NA
401.7091104	3/29/2016	2.988	3.07742	0.02	16.1	0.02	NA
377.000109	3/30/2016	2.799	3.07742	0.05	16.1	0.05	NA
363.3934824	3/31/2016	2.703	3.07742	0.02	16.1	0.02	NA
281.613444	4/7/2016	2.492	2.43637	0.15	13.4	0.15	NA
272.5110846	4/12/2016	2.433	2.43637	0.03	13.4	0.03	NA
264.19452	4/13/2016	2.35	2.43637	0.08	13.4	0.08	NA
264.8093448	4/14/2016	2.366	2.43637	0.02	13.4	0.02	NA
256.862826	4/19/2016	2.295	2.43637	0.02	13.4	0.02	13.4
260.5562784	4/20/2016	2.328	2.43637	0.02	13.4	0.02	NA
245.7824688	4/21/2016	2.196	2.43637	0.02	13.4	0.02	NA

278.895438	4/26/2016	2.49	2.43637	0.03	13.4	0.03	NA	
269.8458708	4/27/2016	2.411	2.43637	0.02	13.4	0.02	NA	
271.972404	4/28/2016	2.43	2.43637	0.02	13.4	0.02	NA	
252.483492	5/3/2016	2.29	2.22839	0.02	13.2	0.02		13.2
239.484768	6/1/2016	2.192	2.1628	0.4	12.7	0.4	NA	
224.899776	6/7/2016	2.12	2.1628	0.02	12.7	0.02		12.7
223.125858	6/8/2016	2.082	2.1628	0.15	12.7	0.15	NA	
216.2008224	6/9/2016	2.038	2.1628	0.02	12.7	0.02	NA	
236.4630192	6/14/2016	2.229	2.1628	0.02	12.7	0.02	NA	
236.8873584	6/15/2016	2.233	2.1628	0.02	12.7	0.02	NA	
227.6579808	6/16/2016	2.146	2.1628	0.02	12.7	0.02	NA	
229.143168	6/21/2016	2.16	2.1628	0.02	12.7	0.02	NA	
226.7032176	6/22/2016	2.137	2.1628	0.02	12.7	0.02	NA	
222.77808	6/23/2016	2.1	2.1628	0.02	12.7	0.02	NA	
218.9590272	6/28/2016	2.064	2.1628	0.02	12.7	0.02	NA	
223.308504	6/29/2016	2.105	2.1628	0.02	12.7	0.02	NA	
216.943416	6/30/2016	2.045	2.1628	0.02	12.7	0.02	NA	
214.6772712	7/5/2016	2.254	2.09394	0.02	11.4	0.02		11.4
203.819592	7/6/2016	2.14	2.09394	0.02	11.4	0.02	NA	
194.771526	7/7/2016	2.045	2.09394	0.02	11.4	0.02	NA	
195.0572544	7/12/2016	2.048	2.09394	0.02	11.4	0.02	NA	
194.0095836	7/13/2016	2.037	2.09394	0.02	11.4	0.02	NA	
189.533172	7/14/2016	1.99	2.09394	0.02	11.4	0.02	NA	
202.39095	7/19/2016	2.125	2.09394	0.02	11.4	0.02	NA	
198.8669664	7/20/2016	2.088	2.09394	0.02	11.4	0.02	NA	
187.8188016	7/21/2016	1.972	2.09394	0.02	11.4	0.02	NA	
187.3425876	7/26/2016	1.967	2.09394	0.02	11.4	0.02	NA	
191.0570568	7/27/2016	2.006	2.09394	0.02	11.4	0.02	NA	
200.2956084	7/28/2016	2.103	2.09394	0.02	11.4	0.02	NA	
174.3753888	8/2/2016	2.026	2.05555	0.02	10.3	0.02	NA	
179.1121752	8/3/2016	2.073	2.05555	0.06	10.3	0.06	NA	
178.0763472	8/4/2016	2.069	2.05555	0.02	10.3	0.02	NA	
176.0967648	8/6/2016	2.046	2.05555	0.02	10.3	NA		10.3
185.436564	8/9/2016	2.078	2.05555	0.4	10.3	0.4	NA	
175.3169748	8/10/2016	2.033	2.05555	0.04	10.3	0.04	NA	
170.3301552	8/11/2016	1.979	2.05555	0.02	10.3	0.02	NA	
183.1544064	8/16/2016	2.128	2.05555	0.02	10.3	0.02	NA	
178.1444016	8/17/2016	2.046	2.05555	0.14	10.3	0.14	NA	
178.7080188	8/18/2016	2.033	2.05555	0.24	10.3	0.24	NA	
174.8057328	8/23/2016	2.031	2.05555	0.02	10.3	0.02	NA	
175.9227924	8/24/2016	2.042	2.05555	0.03	10.3	0.03	NA	
169.555536	8/25/2016	1.97	2.05555	0.02	10.3	0.02	NA	
179.023104	8/30/2016	2.08	2.05555	0.02	10.3	0.02	NA	
176.9154192	8/31/2016	2.028	2.05555	0.16	10.3	0.16	NA	
151.2088704	9/1/2016	1.988	2.2469	0.08	9.04	0.08	NA	
166.988484	9/6/2016	2.21	2.2469	0.02	9.04	0.02		9.04
180.2143896	9/7/2016	2.359	2.2469	0.12	9.04	0.12	NA	

182.3362524	9/8/2016	2.361	2.2469	0.22	9.04	0.22	NA	
180.5746776	9/12/2016	2.356	2.2469	0.15	9.04	0.15	NA	
186.1528032	9/13/2016	2.352	2.2469	0.45	9.04	0.45	NA	
183.5477208	9/14/2016	2.283	2.2469	0.6	9.04	0.6	NA	
176.9937318	9/19/2016	2.241	2.2469	0.43	9.04	0.43	NA	
167.6860416	9/20/2016	2.176	2.2469	0.2	9.04	0.2	NA	
166.7092608	9/21/2016	2.154	2.2469	0.24	9.04	0.24	NA	
164.082828	9/27/2016	2.093	2.2469	0.36	9.04	0.36	NA	
175.3558392	9/28/2016	2.308	2.2469	0.07	9.04	0.07	NA	
174.0944142	9/29/2016	2.247	2.2469	0.25	9.04	0.25	NA	
274.7339448	10/4/2016	2.401	2.80587	0.02	13.7	0.02		13.7
275.8703532	10/5/2016	2.378	2.80587	0.21	13.7	0.21	NA	
267.1325352	10/6/2016	2.316	2.80587	0.13	13.7	0.13	NA	
298.7923428	10/9/2016	2.598	2.80587	0.09	13.7	0.09	NA	
276.5647416	10/10/2016	2.417	2.80587	0.02	13.7	0.02	NA	
248.6154	10/11/2016	2.168	2.80587	0.05	13.7	0.05	NA	
362.0961954	10/17/2016	3.153	2.80587	0.07	13.7	0.07	NA	
342.534225	10/18/2016	2.987	2.80587	0.05	13.7	0.05	NA	
347.5598256	10/19/2016	2.964	2.80587	0.36	13.7	0.36	NA	
303.6834192	10/25/2016	2.654	2.80587	0.02	13.7	0.02	NA	
392.17599	10/26/2016	3.335	2.80587	0.4	13.7	0.4	NA	
367.6468824	10/27/2016	3.213	2.80587	0.02	13.7	0.02	NA	
39.7197504	11/1/2016	3.608	3.4292	0.02	1.3	0.02	NA	
33.9291216	11/3/2016	3.082	3.4292	0.02	1.3	0.02	NA	
32.6631096	11/7/2016	2.967	3.4292	0.02	1.3	0.02	NA	
30.5714376	11/8/2016	2.777	3.4292	0.02	1.3	0.02		1.3
31.6282824	11/9/2016	2.873	3.4292	0.02	1.3	0.02	NA	
47.7451656	11/15/2016	4.337	3.4292	0.02	1.3	0.02	NA	
40.512384	11/16/2016	3.68	3.4292	0.02	1.3	0.02	NA	
36.2312952	11/17/2016	3.242	3.4292	0.04	1.3	0.04	NA	
39.0206916	11/20/2016	3.366	3.4292	0.09	1.3	0.09	NA	
34.2427056	11/21/2016	3.019	3.4292	0.06	1.3	0.06	NA	
35.8499904	11/22/2016	3.232	3.4292	0.03	1.3	0.03	NA	
42.3398448	11/29/2016	3.846	3.4292	0.02	1.3	0.02	NA	
43.099452	11/30/2016	3.915	3.4292	0.02	1.3	0.02	NA	
378.547596	12/1/2016	3.745	3.18406	0.02	12.1	0.02	NA	
337.9131144	12/6/2016	3.343	3.18406	0.02	12.1	0.02		12.1
321.9717882	12/7/2016	3.167	3.18406	0.09	12.1	0.09	NA	
310.585353	12/8/2016	3.055	3.18406	0.09	12.1	0.09	NA	
312.6429144	12/13/2016	3.093	3.18406	0.02	12.1	0.02	NA	
299.4013296	12/14/2016	2.962	3.18406	0.02	12.1	0.02	NA	
295.7750976	12/15/2016	2.888	3.18406	0.18	12.1	0.18	NA	
290.6073	12/19/2016	2.875	3.18406	0.02	12.1	0.02	NA	
292.9601808	12/20/2016	2.884	3.18406	0.08	12.1	0.08	NA	
315.443403	12/27/2016	3.113	3.18406	0.05	12.1	0.05	NA	
301.8421974	12/28/2016	2.969	3.18406	0.09	12.1	0.09	NA	
321.7885584	12/29/2016	3.142	3.18406	0.18	12.1	0.18	NA	

448.4749932	1/3/2017	2.913	2.83858	0.86	17.6	0.86	NA	
411.132393	1/4/2017	2.793	2.83858	0.05	17.6	0.05	NA	
402.2043396	1/5/2017	2.737	2.83858	0.02	17.6	0.02	NA	
417.5747928	1/10/2017	2.742	2.83858	0.66	17.6	0.66		17.6
416.1666672	1/11/2017	2.824	2.83858	0.07	17.6	0.07	NA	
398.7137994	1/12/2017	2.611	2.83858	0.71	17.6	0.71	NA	
441.4402032	1/17/2017	3.004	2.83858	0.02	17.6	0.02	NA	
580.3158816	1/18/2017	3.717	2.83858	1.12	17.6	1.12	NA	
513.149358	1/19/2017	3.49	2.83858	0.03	17.6	0.03	NA	
397.953108	1/24/2017	2.705	2.83858	0.04	17.6	0.04	NA	
421.4528928	1/25/2017	2.736	2.83858	0.87	17.6	0.87	NA	
400.5878808	1/26/2017	2.726	2.83858	0.02	17.6	0.02	NA	
376.950903	1/31/2017	2.555	2.83858	0.09	17.6	0.09	NA	
294.0251988	2/1/2017	2.551	3.23468	0.02	13.8	0.02	NA	
298.182105	2/2/2017	2.509	3.23468	0.45	13.8	0.45	NA	
338.3998368	2/7/2017	2.936	3.23468	0.02	13.8	0.02		13.8
375.5131704	2/8/2017	3.258	3.23468	0.02	13.8	0.02	NA	
468.7497834	2/9/2017	3.989	3.23468	0.29	13.8	0.29	NA	
374.3735928	2/14/2017	3.062	3.23468	0.86	13.8	0.86	NA	
477.6253782	2/15/2017	4.129	3.23468	0.07	13.8	0.07	NA	
468.034128	2/16/2017	4.02	3.23468	0.16	13.8	0.16	NA	
383.2787112	2/21/2017	3.311	3.23468	0.08	13.8	0.08	NA	
376.2047232	2/22/2017	3.264	3.23468	0.02	13.8	0.02	NA	
355.1123628	2/23/2017	3.081	3.23468	0.02	13.8	0.02	NA	
375.3705564	2/28/2017	3.087	3.23468	0.78	13.8	0.78	NA	
473.7123336	3/1/2017	3.092	3.55358	0.47	17.9	0.47		17.9
340.1003628	3/2/2017	3.014	3.55358	0.03	13.5	0.03		13.5
480.4100208	3/7/2017	3.702	3.55358	0.46	15.1	0.46		15.1
530.6626908	3/8/2017	3.498	3.55358	0.39	17.8	0.39		17.8
588.8735556	3/9/2017	3.586	3.55358	0.19	19.5	0.19		19.5
348.35346	3/14/2017	3.825	3.55358	0.02	10.9	0.02		10.9
414.1465524	3/15/2017	4.379	3.55358	0.04	11.3	0.04		11.3
387.139464	3/16/2017	3.83	3.55358	0.02	12.1	0.02		12.1
440.508375	3/21/2017	3.375	3.55358	0.15	15.5	0.15		15.5
469.8085464	3/22/2017	3.188	3.55358	0.77	16.9	0.77		16.9
523.2518502	3/23/2017	3.077	3.55358	0.49	19.9	0.49		19.9
286.2184584	3/28/2017	3.358	3.55358	0.02	10.2	0.02		10.2
529.6879116	3/29/2017	4.002	3.55358	0.17	15.7	0.17		15.7
1.299789	4/4/2017	3.117	3.26913	0.04	0.01	0.04		0.01
0.8128998	4/5/2017	3.249	3.26913	0.02	0.01	0.02	NA	
0.7863786	4/6/2017	3.143	3.26913	0.02	0.01	0.02	NA	
3.848076	4/11/2017	3.076	3.26913	0.14	0.01	0.14	NA	
0.9415026	4/12/2017	3.763	3.26913	0.02	0.01	0.02	NA	
0.9400014	4/13/2017	3.757	3.26913	0.02	0.01	0.02	NA	
0.7150716	4/18/2017	2.858	3.26913	0.02	0.01	0.02	NA	
0.746847	4/19/2017	2.985	3.26913	0.02	0.01	0.02	NA	
10.3042368	4/20/2017	3.861	3.26913	0.31	0.01	0.31	NA	

0.773118	4/25/2017	3.09	3.26913	0.02	0.01	0.02	NA	
0.8446752	4/26/2017	3.376	3.26913	0.02	0.01	0.02	NA	
30.0914706	4/27/2017	3.193	3.26913	1.12	0.01	1.12	NA	
375.9531888	5/2/2017	2.828	2.92835	0.04	15.9	0.04		15.9
391.2814416	5/3/2017	2.947	2.92835	0.02	15.9	0.02	NA	
439.6107408	5/4/2017	3.311	2.92835	0.02	15.9	0.02	NA	
380.9251632	5/9/2017	2.869	2.92835	0.02	15.9	0.02	NA	
411.46224	5/10/2017	2.8	2.92835	1.72	15.9	1.72	NA	
378.9994572	5/11/2017	2.842	2.92835	0.09	15.9	0.09	NA	
481.5669456	5/16/2017	3.627	2.92835	0.02	15.9	0.02	NA	
403.5077148	5/18/2017	3.022	2.92835	0.11	15.9	0.11	NA	
387.0934272	5/23/2017	2.844	2.92835	0.42	15.9	0.42	NA	
372.2919288	5/24/2017	2.783	2.92835	0.14	15.9	0.14	NA	
377.4730704	5/25/2017	2.843	2.92835	0.02	15.9	0.02	NA	
349.5276486	5/30/2017	2.621	2.92835	0.09	15.9	0.09	NA	
343.3117632	5/31/2017	2.576	2.92835	0.08	15.9	0.08	NA	
308.556648	6/1/2017	2.58	2.41167	0.04	14.3	0.04	NA	
296.5849116	6/6/2017	2.473	2.41167	0.08	14.3	0.08		14.3
291.439632	6/7/2017	2.42	2.41167	0.14	14.3	0.14	NA	
301.6771488	6/8/2017	2.526	2.41167	0.02	14.3	0.02	NA	
290.4508416	6/13/2017	2.432	2.41167	0.02	14.3	0.02	NA	
305.2600128	6/14/2017	2.556	2.41167	0.02	14.3	0.02	NA	
289.3759824	6/15/2017	2.423	2.41167	0.02	14.3	0.02	NA	
280.9625904	6/20/2017	2.346	2.41167	0.06	14.3	0.06	NA	
290.034342	6/21/2017	2.41	2.41167	0.13	14.3	0.13	NA	
275.1170844	6/22/2017	2.302	2.41167	0.03	14.3	0.03	NA	
276.9553872	6/27/2017	2.319	2.41167	0.02	14.3	0.02	NA	
275.283384	6/28/2017	2.305	2.41167	0.02	14.3	0.02	NA	
276.3582432	6/29/2017	2.314	2.41167	0.02	14.3	0.02	NA	
252.5989176	7/4/2017	2.298	2.21252	0.08	13.1	0.08	NA	
262.93518	7/5/2017	2.325	2.21252	0.46	13.1	0.46	NA	
257.53086	7/6/2017	2.35	2.21252	0.04	13.1	0.04	NA	
268.4092224	7/11/2017	2.453	2.21252	0.02	13.1	0.02		13.1
239.5221312	7/12/2017	2.189	2.21252	0.02	13.1	0.02	NA	
241.4917056	7/13/2017	2.207	2.21252	0.02	13.1	0.02	NA	
242.004282	7/18/2017	2.21	2.21252	0.03	13.1	0.03	NA	
252.8781408	7/19/2017	2.172	2.21252	0.86	13.1	0.86	NA	
228.5800512	7/20/2017	2.089	2.21252	0.02	13.1	0.02	NA	
251.3819448	7/23/2017	2.268	2.21252	0.19	13.1	0.19	NA	
264.798336	7/24/2017	2.42	2.21252	0.02	13.1	0.02	NA	
232.3417248	7/25/2017	2.032	2.21252	0.61	13.1	0.61	NA	
466.155126	8/1/2017	2.11	2.08839	0.19	26.3	0.19	NA	
459.819228	8/2/2017	2.09	2.08839	0.08	26.3	0.08	NA	
470.282592	8/3/2017	2.08	2.08839	0.81	26.3	0.81	NA	
488.150208	8/8/2017	2.08	2.08839	1.84	26.3	1.84		26.3
454.26312	8/9/2017	2.04	2.08839	0.4	26.3	0.4	NA	
489.504624	8/10/2017	2.23	2.08839	0.02	26.3	0.02	NA	

481.62666	8/15/2017	2.15	2.08839	0.56	26.3	0.56	NA	
456.578304	8/16/2017	2.08	2.08839	0.02	26.3	0.02	NA	
467.14008	8/17/2017	2.09	2.08839	0.5	26.3	0.5	NA	
456.578304	8/21/2017	2.08	2.08839	0.02	26.3	0.02	NA	
463.163568	8/22/2017	2.11	2.08839	0.02	26.3	0.02	NA	
468.266814	8/23/2017	2.11	2.08839	0.31	26.3	0.31	NA	
470.462736	8/28/2017	2.14	2.08839	0.06	26.3	0.06	NA	
459.5757	8/29/2017	2.06	2.08839	0.45	26.3	0.45	NA	
452.70354	8/30/2017	2.06	2.08839	0.05	26.3	0.05	NA	
353.6281764	9/4/2017	2.253	2.09257	0.42	18.4	0.42	NA	
331.3905672	9/5/2017	2.156	2.09257	0.03	18.4	0.03	NA	
324.4506864	9/6/2017	2.104	2.09257	0.09	18.4	0.09	NA	
317.52882	9/12/2017	2.058	2.09257	0.1	18.4	0.1		18.4
331.9788708	9/13/2017	2.161	2.09257	0.02	18.4	0.02	NA	
310.0108104	9/14/2017	2.018	2.09257	0.02	18.4	0.02	NA	
330.1353972	9/19/2017	2.149	2.09257	0.02	18.4	0.02	NA	
316.9238364	9/20/2017	2.063	2.09257	0.02	18.4	0.02	NA	
319.4973936	9/21/2017	2.073	2.09257	0.08	18.4	0.08	NA	
316.6165908	9/26/2017	2.061	2.09257	0.02	18.4	0.02	NA	
316.462968	9/27/2017	2.06	2.09257	0.02	18.4	0.02	NA	
309.0890736	9/28/2017	2.012	2.09257	0.02	18.4	0.02	NA	
303.697764	10/3/2017	2.055	2.291	0.02	17.7	0.02		17.7
301.6287768	10/4/2017	2.041	2.291	0.02	17.7	0.02	NA	
302.9686812	10/5/2017	2.042	2.291	0.09	17.7	0.09	NA	
293.352828	10/6/2017	1.985	2.291	0.02	17.7	0.02	NA	
340.2006096	10/8/2017	2.302	2.291	0.02	17.7	0.02	NA	
315.6683328	10/9/2017	2.136	2.291	0.02	17.7	0.02	NA	
307.739328	10/10/2017	2.08	2.291	0.04	17.7	0.04	NA	
313.3614888	10/16/2017	2.118	2.291	0.04	17.7	0.04	NA	
319.7234076	10/17/2017	2.161	2.291	0.04	17.7	0.04	NA	
392.003352	10/18/2017	2.62	2.291	0.24	17.7	0.24	NA	
354.839895	10/24/2017	2.397	2.291	0.05	17.7	0.05	NA	
347.8854192	10/25/2017	2.354	2.291	0.02	17.7	0.02	NA	
332.9591544	10/26/2017	2.253	2.291	0.02	17.7	0.02	NA	
320.1018768	10/31/2017	2.166	2.291	0.02	17.7	0.02	NA	
414.41877	11/1/2017	3.165	NA	0.1	15.6	NA	NA	
380.37489	12/5/2017	2.905	3.134	0.1	15.6	0.1		15.6
383.3993076	12/6/2017	2.798	3.134	0.83	15.6	0.83	NA	
356.378208	12/7/2017	2.72	3.134	0.11	15.6	0.11	NA	
326.8124076	12/12/2017	2.477	3.134	0.22	15.6	0.22	NA	
344.3555976	12/13/2017	2.468	3.134	1.13	15.6	1.13	NA	
321.5850624	12/14/2017	2.416	3.134	0.36	15.6	0.36	NA	
508.4053992	12/17/2017	3.756	3.134	0.63	15.6	0.63	NA	
536.4227952	12/20/2017	4.076	3.134	0.18	15.6	0.18	NA	
491.8404912	12/21/2017	3.502	3.134	1.24	15.6	1.24	NA	
382.8240144	12/26/2017	2.844	3.134	0.54	15.6	0.54	NA	
361.6736076	12/27/2017	2.707	3.134	0.42	15.6	0.42	NA	

371.6627592	12/28/2017	2.714	3.134	0.82	15.6	0.82	NA	
270.9926208	1/2/2018	3.077	3.624	0.16	10.4	0.16	NA	
242.8064232	1/3/2018	2.794	3.624	0.02	10.4	0.02	NA	
246.807288	1/4/2018	2.73	3.624	0.44	10.4	0.44	NA	
405.161787	1/9/2018	4.357	3.624	0.75	10.4	0.75		10.4
358.7835474	1/10/2018	4.047	3.624	0.23	10.4	0.23	NA	
442.9448226	1/11/2018	4.959	3.624	0.31	10.4	0.31	NA	
286.5185316	1/16/2018	3.297	3.624	0.02	10.4	0.02	NA	
297.8158956	1/17/2018	3.427	3.624	0.02	10.4	0.02	NA	
320.3237208	1/18/2018	3.686	3.624	0.02	10.4	0.02	NA	
318.4118592	1/23/2018	3.664	3.624	0.02	10.4	0.02	NA	
332.9246268	1/24/2018	3.831	3.624	0.02	10.4	0.02	NA	
306.2454672	1/25/2018	3.524	3.624	0.02	10.4	0.02	NA	
380.19975	1/30/2018	4.375	3.624	0.02	10.4	0.02	NA	
317.3690256	1/31/2018	3.652	3.624	0.02	10.4	0.02	NA	
228.4586208	2/6/2018	4.476	3.74	0.02	6.1	0.02		6.1
358.1107596	3/6/2018	2.838	3.08394	1.43	13.7	1.43		13.7
343.471224	4/3/2018	2.98	3.5245	0.12	13.7	0.12		13.7
515.054214	5/8/2018	2.67	2.55	0.13	23	0.13		23
212.47401	6/3/2018	2.51	2.47	0.05	10.1	0.05		10.1
226.1617848	7/1/2018	2.532	2.2261	0.41	10.3	0.41		10.3
292.3565316	7/4/2018	2.359	2.2261	4.56	10.3	4.56	NA	
209.4534288	7/5/2018	2.376	2.2261	0.27	10.3	0.27	NA	
293.7262932	7/10/2018	2.162	2.2261	5.99	10.3	5.99	NA	
200.316375	7/11/2018	2.135	2.2261	0.95	10.3	0.95	NA	
190.992672	7/12/2018	2.202	2.2261	0.1	10.3	0.1	NA	
193.5106848	7/16/2018	2.214	2.2261	0.18	10.3	0.18	NA	
221.226006	7/18/2018	2.185	2.2261	1.84	10.3	1.84	NA	
187.5839472	7/19/2018	2.106	2.2261	0.38	10.3	0.38	NA	
186.880635	7/24/2018	2.165	2.2261	0.05	10.3	0.05	NA	
183.7966698	7/25/2018	2.117	2.2261	0.11	10.3	0.11	NA	
187.9336434	7/26/2018	2.173	2.2261	0.07	10.3	0.07	NA	
187.1017284	7/31/2018	2.153	2.2261	0.12	10.3	0.12	NA	
234.5098746	8/3/2018	2.063	2.15	1.53	12.1	1.53	NA	
240.157806	8/4/2018	2.17	2.15	1.17	12.1	1.17	NA	
256.7745888	8/5/2018	2.284	2.15	1.38	12.1	1.38	NA	
238.0621308	8/6/2018	2.174	2.15	1.03	12.1	1.03	NA	
236.0910552	8/7/2018	2.156	2.15	1.03	12.1	NA		12.1
260.0018352	8/11/2018	2.264	2.15	1.67	12.1	1.67	NA	
264.5167776	8/12/2018	2.374	2.15	1.26	12.1	1.26	NA	
277.3256832	8/13/2018	2.208	2.15	2.96	12.1	2.96	NA	
268.58553	8/16/2018	2.221	2.15	2.4	12.1	2.4	NA	
264.9157632	8/19/2018	2.256	2.15	1.98	12.1	1.98	NA	
261.569088	8/21/2018	2.178	2.15	2.3	12.1	2.3	NA	
264.6155232	8/25/2018	2.128	2.15	2.81	12.1	2.81	NA	
292.3872228	8/26/2018	2.278	2.15	3.29	12.1	3.29	NA	
328.4865792	8/27/2018	2.104	2.15	6.62	12.1	6.62	NA	

197.377776	9/3/2018	2.28	2.37	1.35	9.03	1.35	NA	
171.216864	9/4/2018	2.184	2.37	0.37	9.03	0.37		9.03
217.6592382	9/5/2018	2.103	2.37	3.38	9.03	3.38	NA	
175.6676718	9/11/2018	2.287	2.37	0.18	9.03	0.18	NA	
173.098368	9/12/2018	2.256	2.37	0.17	9.03	0.17	NA	
184.330263	9/13/2018	2.405	2.37	0.16	9.03	0.16	NA	
187.8719274	9/17/2018	2.399	2.37	0.36	9.03	0.36	NA	
179.16822	9/18/2018	2.31	2.37	0.27	9.03	0.27	NA	
180.0524268	9/19/2018	2.263	2.37	0.51	9.03	0.51	NA	
202.1967948	9/25/2018	2.422	2.37	0.98	9.03	0.98	NA	
212.7697464	9/26/2018	2.371	2.37	1.73	9.03	1.73	NA	
243.468369	9/27/2018	2.237	2.37	4.02	9.03	4.02	NA	
284.6178456	10/2/2018	2.564	2.46	4.66	8.65	4.66		8.65
336.1150104	10/3/2018	2.522	2.46	7.33	8.65	7.33	NA	
346.957344	10/4/2018	2.43	2.46	8.47	8.65	8.47	NA	
270.1761348	10/7/2018	2.651	2.46	3.57	8.65	3.57	NA	
261.6731712	10/8/2018	2.668	2.46	3.11	8.65	3.11	NA	
220.3940076	10/9/2018	2.479	2.46	2.01	8.65	2.01	NA	
225.0046098	10/16/2018	2.181	2.46	3.72	8.65	3.72	NA	
253.9226424	10/17/2018	2.242	2.46	4.93	8.65	4.93	NA	
275.2520256	10/18/2018	2.218	2.46	6.23	8.65	6.23	NA	
207.847395	10/23/2018	2.121	2.46	3.1	8.65	3.1	NA	
233.891964	10/24/2018	2.174	2.46	4.25	8.65	4.25	NA	
281.031312	10/25/2018	2.92	2.46	2.89	8.65	2.89	NA	
196.960776	10/30/2018	2.567	2.46	0.55	8.65	0.55	NA	
211.4149968	10/31/2018	2.674	2.46	0.83	8.65	0.83	NA	
238.735836	11/6/2018	3.078	2.954	0.36	8.94	0.36		8.94
261.201294	12/2/2018	3.026	2.94	1.53	8.82	1.53		8.82
351.537255	1/8/2019	3.225	2.88	1.27	11.8	1.27		11.8
215.8685568	2/5/2019	2.652	2.93	1.52	8.24	1.52		8.24
347.3586648	3/5/2019	2.506	2.68	4.52	12.1	4.52		12.1
321.0836616	4/9/2019	2.553	2.76	0.28	14.8	0.28		14.8
460.591929	5/7/2019	2.471	2.47	1.65	20.7	1.65		20.7
483.913488	6/4/2019	2.32	2.35	1.01	24	1.01		24
176.5896588	7/1/2019	2.154	2.17	0.03	9.8	0.03	NA	
257.678061	7/2/2019	2.771	2.17	1.35	9.8	1.35	NA	
193.9255164	7/9/2019	2.157	2.17	0.98	9.8	0.98		9.8
192.72072	7/10/2019	2.18	2.17	0.8	9.8	0.8	NA	
193.289508	7/11/2019	2.166	2.17	0.9	9.8	0.9	NA	
245.9613618	7/14/2019	2.253	2.17	3.29	9.8	3.29	NA	
221.0897304	7/16/2019	2.114	2.17	2.74	9.8	2.74	NA	
257.376987	7/17/2019	2.121	2.17	4.75	9.8	4.75	NA	
214.87176	7/23/2019	2.147	2.17	2.2	9.8	2.2	NA	
250.67538	7/24/2019	2.15	2.17	4.18	9.8	4.18	NA	
227.8417944	7/25/2019	2.141	2.17	2.96	9.8	2.96	NA	
204.9318144	7/30/2019	2.133	2.17	1.72	9.8	1.72	NA	
206.4818034	7/31/2019	2.151	2.17	1.71	9.8	1.71	NA	

207.5549112	8/1/2019	2.067	2.12	1.34	10.7	1.34	NA	
207.797355	8/6/2019	2.085	2.12	1.25	10.7	1.25		10.7
213.0742398	8/7/2019	2.089	2.12	1.53	10.7	1.53	NA	
214.1195754	8/8/2019	2.089	2.12	1.59	10.7	1.59	NA	
195.79401	8/13/2019	2.115	2.12	0.4	10.7	0.4	NA	
205.003872	8/14/2019	2.16	2.12	0.68	10.7	0.68	NA	
202.0525128	8/15/2019	2.076	2.12	0.97	10.7	0.97	NA	
194.7013032	8/20/2019	2.077	2.12	0.54	10.7	0.54	NA	
220.7807334	8/21/2019	2.147	2.12	1.63	10.7	1.63	NA	
205.2104538	8/22/2019	2.123	2.12	0.89	10.7	0.89	NA	
225.9652944	8/25/2019	2.273	2.12	1.22	10.7	1.22	NA	
200.039904	8/27/2019	2.104	2.12	0.7	10.7	0.7	NA	
206.0957448	8/28/2019	2.134	2.12	0.88	10.7	0.88	NA	
248.4465984	9/2/2019	2.288	2.441	3.76	9.26	3.76	NA	
192.8454864	9/3/2019	2.198	2.441	1.26	9.26	1.26	NA	
202.46601	9/4/2019	2.111	2.441	2.24	9.26	2.24	NA	
204.106488	9/10/2019	2.36	2.441	1.11	9.26	1.11		9.26
186.103764	9/11/2019	2.277	2.441	0.54	9.26	0.54	NA	
202.5242232	9/12/2019	2.278	2.441	1.4	9.26	1.4	NA	
210.1656648	9/17/2019	2.548	2.441	0.63	9.26	0.63	NA	
250.5722976	9/18/2019	2.544	2.441	2.55	9.26	2.55	NA	
231.0808836	9/19/2019	2.401	2.441	2.28	9.26	2.28	NA	
199.799712	9/24/2019	2.576	2.441	0.04	9.26	0.04	NA	
192.0170742	9/25/2019	2.473	2.441	0.05	9.26	0.05	NA	
207.2249808	9/26/2019	2.666	2.441	0.06	9.26	0.06	NA	
203.7623796	9/30/2019	2.561	2.441	0.28	9.26	0.28	NA	
374.4908532	10/1/2019	2.391	2.58	1.08	17.7	1.08		17.7
415.0807992	10/2/2019	2.361	2.58	3.38	17.7	3.38	NA	
395.1786402	10/6/2019	2.571	2.58	0.73	17.7	0.73	NA	
410.5365	10/7/2019	2.75	2.58	0.2	17.7	0.2	NA	
422.0818956	10/8/2019	2.682	2.58	1.17	17.7	1.17	NA	
364.97925	10/15/2019	2.334	2.58	1.05	17.7	1.05	NA	
371.648748	10/16/2019	2.462	2.58	0.4	17.7	0.4	NA	
368.9927082	10/17/2019	2.487	2.58	0.09	17.7	0.09	NA	
501.945402	10/22/2019	3.385	2.58	0.08	17.7	0.08	NA	
434.4367716	10/23/2019	2.938	2.58	0.03	17.7	0.03	NA	
408.116232	10/24/2019	2.76	2.58	0.03	17.7	0.03	NA	
348.134952	10/29/2019	2.332	2.58	0.2	17.7	0.2	NA	
367.2470628	10/30/2019	2.346	2.58	1.07	17.7	1.07	NA	
337.783761	10/31/2019	2.269	2.58	0.15	17.7	0.15	NA	
303.422544	11/5/2019	2.232	2.52	0.3	16	0.3		16
242.6563866	12/3/2019	2.311	2.94	0.09	12.5	0.09		12.5
472.0600962	1/7/2020	3.531	3.42	0.13	15.9	0.13		15.9
797.7063216	2/5/2020	6.911	3.64	0.04	13.8	0.04		13.8
319.89738	3/3/2020	3.17	2.83	0.1	12	0.1		12
53.5046862	4/14/2020	2.477	2.6	2.22	0.37	2.22		0.37
283.265181	5/5/2020	2.715	2.72	0.31	12.2	0.31		12.2

606.3091596	6/9/2020	3.306	3.035	12.9	9.09	12.9		9.09
372.7031742	7/1/2020	2.649	2.45	0.07	16.8	0.07	NA	
363.0695568	7/7/2020	2.579	2.45	0.08	16.8	0.08		16.8
352.2295584	7/8/2020	2.502	2.45	0.08	16.8	0.08	NA	
347.0410776	7/9/2020	2.471	2.45	0.04	16.8	0.04	NA	
460.916772	7/14/2020	2.74	2.45	3.37	16.8	3.37	NA	
349.1330832	7/15/2020	2.424	2.45	0.47	16.8	0.47	NA	
346.6213254	7/16/2020	2.401	2.45	0.51	16.8	0.51	NA	
351.550599	7/21/2020	2.455	2.45	0.37	16.8	0.37	NA	
338.114025	7/22/2020	2.375	2.45	0.27	16.8	0.27	NA	
327.4650126	7/23/2020	2.333	2.45	0.03	16.8	0.03	NA	
331.057968	7/28/2020	2.36	2.45	0.02	16.8	0.02	NA	
331.4788044	7/29/2020	2.363	2.45	0.02	16.8	0.02	NA	
322.7815188	7/30/2020	2.301	2.45	0.02	16.8	0.02	NA	
302.720733	8/2/2020	2.415	2.295	0.03	15	0.03	NA	
294.5714688	8/3/2020	2.336	2.295	0.12	15	0.12	NA	
292.5233316	8/4/2020	2.329	2.295	0.06	15	0.06	NA	
286.7357052	8/11/2020	2.289	2.295	0.02	15	0.02		15
286.6201128	8/12/2020	2.282	2.295	0.06	15	0.06	NA	
286.6104384	8/13/2020	2.288	2.295	0.02	15	0.02	NA	
289.8770496	8/18/2020	2.311	2.295	0.04	15	0.04	NA	
288.6147072	8/19/2020	2.304	2.295	0.02	15	0.02	NA	
282.3513672	8/20/2020	2.254	2.295	0.02	15	0.02	NA	
277.8417624	8/25/2020	2.218	2.295	0.02	15	0.02	NA	
269.0730864	8/26/2020	2.148	2.295	0.02	15	0.02	NA	
276.213294	8/27/2020	2.205	2.295	0.02	15	0.02	NA	
290.1279168	8/30/2020	2.313	2.295	0.04	15	0.04	NA	
289.8096624	8/31/2020	2.312	2.295	0.03	15	0.03	NA	
240.627348	9/1/2020	2.34	2.37	0.03	12.3	0.03	NA	
243.854928	9/7/2020	2.358	2.37	0.1	12.3	0.1	NA	
234.8217072	9/8/2020	2.278	2.37	0.06	12.3	0.06	NA	
228.1213512	9/9/2020	2.213	2.37	0.06	12.3	0.06	NA	
243.2009052	9/15/2020	2.346	2.37	0.13	12.3	0.13		12.3
237.735036	9/16/2020	2.31	2.37	0.04	12.3	0.04	NA	
237.735036	9/17/2020	2.31	2.37	0.04	12.3	0.04	NA	
241.337082	9/22/2020	2.345	2.37	0.04	12.3	0.04	NA	
265.222425	9/23/2020	2.575	2.37	0.05	12.3	0.05	NA	
253.3692	9/24/2020	2.45	2.37	0.1	12.3	0.1	NA	
255.8481816	9/28/2020	2.486	2.37	0.04	12.3	0.04	NA	
249.154581	9/29/2020	2.419	2.37	0.05	12.3	0.05	NA	
247.1915952	9/30/2020	2.398	2.37	0.06	12.3	0.06	NA	
185.122146	10/6/2020	2.374	2.68	0.29	9.06	0.29		9.06
182.580948	10/7/2020	2.354	2.68	0.24	9.06	0.24	NA	
185.554992	10/8/2020	2.32	2.68	0.53	9.06	0.53	NA	
218.57472	10/11/2020	2.88	2.68	0.04	9.06	0.04	NA	
206.9624376	10/12/2020	2.724	2.68	0.05	9.06	0.05	NA	
213.3445392	10/13/2020	2.808	2.68	0.05	9.06	0.05	NA	

277.614414	10/18/2020	3.63	2.68	0.11	9.06	0.11	NA	
251.2572618	10/19/2020	3.307	2.68	0.05	9.06	0.05	NA	
227.172426	10/20/2020	2.99	2.68	0.05	9.06	0.05	NA	
195.1099632	10/27/2020	2.568	2.68	0.05	9.06	0.05	NA	
193.8029184	10/28/2020	2.548	2.68	0.06	9.06	0.06	NA	
190.912608	10/29/2020	2.51	2.68	0.06	9.06	0.06	NA	
330.608025	11/3/2020	2.883	3.05	0.15	13.6	0.15		13.6

ATTACHMENT B

REVISED PERMIT ACTION LEVEL ALTERNATIVE 1

Data, Controls, Numeric Output

significant digits to display

3

386 Daily

141,000 Annual

Fix Random number Seed

Action Level based on 597 data points Over 1800 days

Please select Data file

Browse... WA0020893DAYmp002_PlantProcess(alt1).cs

Upload complete

Earliest Data to consider for calculation

2016-01-05

Latest Data to consider for calculation

2020-12-31

Samples per month (per year/12)

1 8 30

1 4 7 10 13 16 19 22 25 28 30

Thousands of iterations

4 100

4 14 24 34 44 54 64 74 84 94 100

Confidence Level Needed

90 99

90 91 92 93 94 95 96 97 98 99

If Date is not second field input, data assumed to be sequential months starting in Jan 2015

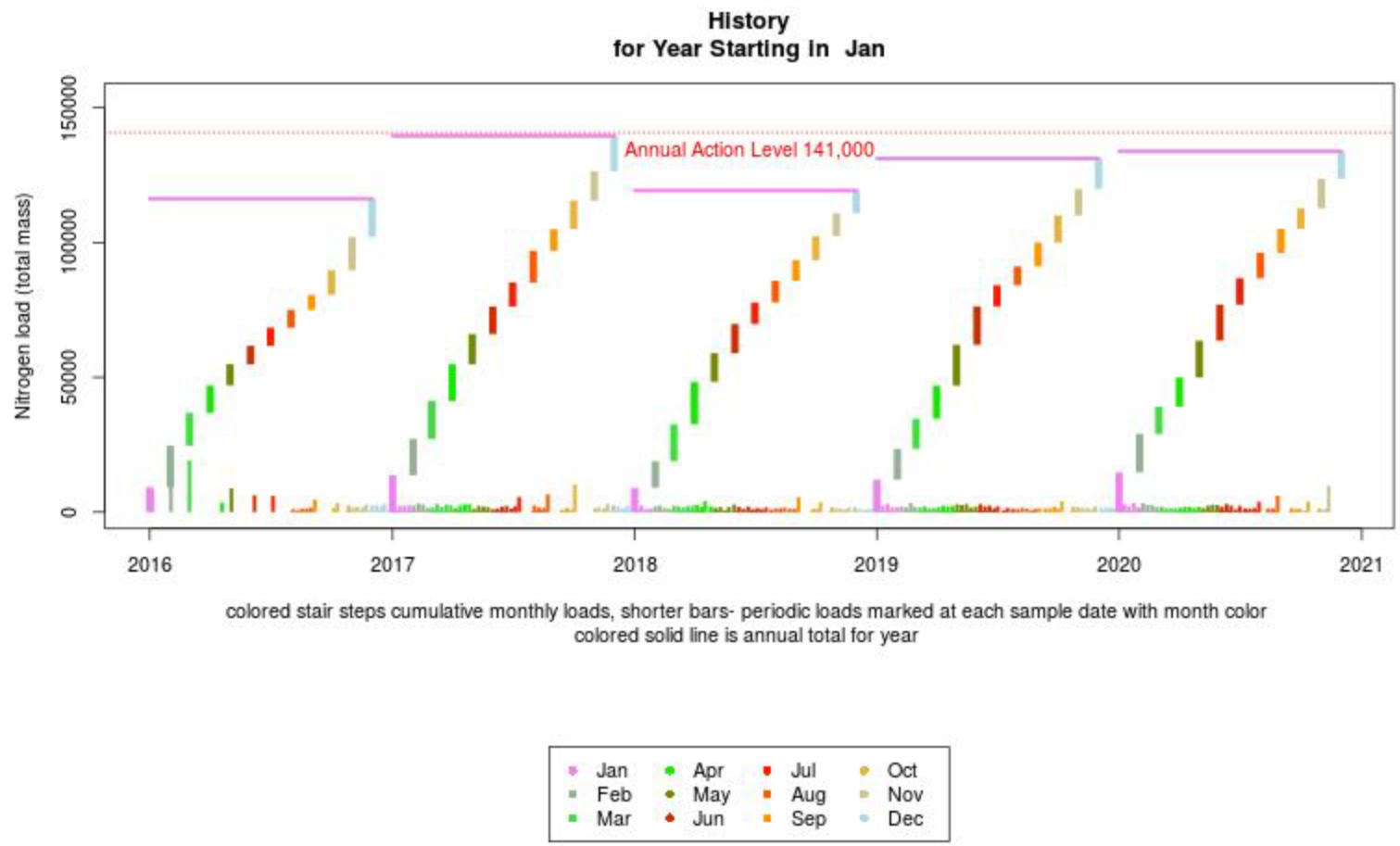
WA0020893DAYmp002_PlantProcess(alt1).csv

DataTable | Summary | Individual | Annual | Version | Help

first month of year

Jan

Extrapolate data to ends of year



load	POS	Q2	Qave	AMM	NIT	Ammonia	Nitrate...Nitrite
297.7915428	1/5/2016	2.511	3.12294	0.02	14.2	0.02	14.2
540.1277568	2/2/2016	2.848	2.97866	0.04	22.7	0.04	22.7
392.567136	3/1/2016	2.92	3.07742	0.02	16.1	0.02	16.1
256.862826	4/19/2016	2.295	2.43637	0.02	13.4	0.02	13.4
252.483492	5/3/2016	2.29	2.22839	0.02	13.2	0.02	13.2
224.899776	6/7/2016	2.12	2.1628	0.02	12.7	0.02	12.7
214.6772712	7/5/2016	2.254	2.09394	0.02	11.4	0.02	11.4
187.8928608	8/2/2016	2.026	2.05555	0.02	11.1	0.02	11.1
241.3519272	8/3/2016	2.073	2.05555	0.06	13.9	0.06	13.9
202.2339912	8/4/2016	2.069	2.05555	0.02	11.7	0.02	11.7
221.830656	8/9/2016	2.078	2.05555	0.4	12.4	0.4	12.4
221.0960688	8/10/2016	2.033	2.05555	0.04	13	0.04	13
157.1262672	8/11/2016	1.979	2.05555	0.02	9.5	0.02	9.5
167.1816384	8/16/2016	2.128	2.05555	0.02	9.4	0.02	9.4
203.7398616	8/17/2016	2.046	2.05555	0.14	11.8	0.14	11.8
248.2244208	8/18/2016	2.033	2.05555	0.24	14.4	0.24	14.4
173.1118788	8/23/2016	2.031	2.05555	0.02	10.2	0.02	10.2
213.3894084	8/24/2016	2.042	2.05555	0.03	12.5	0.03	12.5
254.990496	8/25/2016	1.97	2.05555	0.02	15.5	0.02	15.5
205.043904	8/30/2016	2.08	2.05555	0.02	11.8	0.02	11.8
275.0138352	8/31/2016	2.028	2.05555	0.16	16.1	0.16	16.1
166.988484	9/6/2016	2.21	2.2469	0.02	9.04	0.02	9.04
300.7655868	10/4/2016	2.401	2.80587	0.02	15	0.02	15
248.9575068	10/9/2016	2.598	2.80587	0.09	11.4	0.09	11.4
224.1545136	10/10/2016	2.417	2.80587	0.02	11.1	0.02	11.1
363.4461912	10/25/2016	2.654	2.80587	0.02	16.4	0.02	16.4
628.59414	10/26/2016	3.335	2.80587	0.4	22.2	0.4	22.2
501.6289824	10/27/2016	3.213	2.80587	0.02	18.7	0.02	18.7
418.8628224	11/1/2016	3.608	3.4292	0.02	13.9	0.02	13.9
414.3465456	11/3/2016	3.082	3.4292	0.02	16.1	0.02	16.1
337.0239036	11/7/2016	2.967	3.4292	0.02	13.6	0.02	13.6
354.8139576	11/8/2016	2.777	3.4292	0.02	15.3	0.02	15.3
323.9502864	11/9/2016	2.873	3.4292	0.02	13.5	0.02	13.5
456.4727196	11/15/2016	4.337	3.4292	0.02	12.6	0.02	12.6
537.709824	11/16/2016	3.68	3.4292	0.02	17.5	0.02	17.5
576.9968952	11/17/2016	3.242	3.4292	0.04	21.3	0.04	21.3
401.1551676	11/20/2016	3.366	3.4292	0.09	14.2	0.09	14.2
369.1162236	11/21/2016	3.019	3.4292	0.06	14.6	0.06	14.6
391.6544064	11/22/2016	3.232	3.4292	0.03	14.5	0.03	14.5
433.6626528	11/29/2016	3.846	3.4292	0.02	13.5	0.02	13.5
516.540402	11/30/2016	3.915	3.4292	0.02	15.8	0.02	15.8
506.604126	12/1/2016	3.745	3.18406	0.02	16.2	0.02	16.2
432.7072224	12/6/2016	3.343	3.18406	0.02	15.5	0.02	15.5
514.7850822	12/7/2016	3.167	3.18406	0.09	19.4	0.09	19.4
496.579863	12/8/2016	3.055	3.18406	0.09	19.4	0.09	19.4
346.1772204	12/13/2016	3.093	3.18406	0.02	13.4	0.02	13.4

353.7481056	12/14/2016	2.962	3.18406	0.02	14.3	0.02	14.3
529.4085216	12/15/2016	2.888	3.18406	0.18	21.8	0.18	21.8
283.41405	12/19/2016	2.875	3.18406	0.02	11.8	0.02	11.8
451.7070768	12/20/2016	2.884	3.18406	0.08	18.7	0.08	18.7
377.753211	12/27/2016	3.113	3.18406	0.05	14.5	0.05	14.5
341.4605334	12/28/2016	2.969	3.18406	0.09	13.7	0.09	13.7
413.5035384	12/29/2016	3.142	3.18406	0.18	15.6	0.18	15.6
426.7071929	1/3/2017	2.913	2.83858	0.864	16.7	0.864	16.7
390.168135	1/4/2017	2.793	2.83858	0.05	16.7	0.05	16.7
304.0500456	1/5/2017	2.737	2.83858	0.02	13.3	0.02	13.3
458.7376968	1/10/2017	2.742	2.83858	0.66	19.4	0.66	19.4
510.3753072	1/11/2017	2.824	2.83858	0.07	21.6	0.07	21.6
470.5737414	1/12/2017	2.611	2.83858	0.71	20.9	0.71	20.9
268.5720192	1/17/2017	3.004	2.83858	0.02	10.7	0.02	10.7
636.1154856	1/18/2017	3.717	2.83858	1.12	19.4	1.12	19.4
469.489458	1/19/2017	3.49	2.83858	0.03	16.1	0.03	16.1
415.9106292	1/24/2017	2.705	2.83858	0.036	18.4	0.036	18.4
560.6213386	1/25/2017	2.736	2.83858	0.869	23.7	0.869	23.7
491.5954453	1/26/2017	2.726	2.83858	0.023	21.6	0.023	21.6
517.6522491	1/31/2017	2.555	2.83858	0.093	24.2	0.093	24.2
402.4230561	2/1/2017	2.551	3.23468	0.015	18.9	0.015	18.9
484.3732889	2/2/2017	2.509	3.23468	0.448	22.7	0.448	22.7
382.5240413	2/7/2017	2.936	3.23468	0.022	15.6	0.022	15.6
356.438623	2/8/2017	3.258	3.23468	0.018	13.1	0.018	13.1
658.3788654	2/9/2017	3.989	3.23468	0.29	19.5	0.29	19.5
430.4785576	2/14/2017	3.062	3.23468	0.857	16	0.857	16
498.2868942	2/15/2017	4.129	3.23468	0.07	14.4	0.07	14.4
558.4894344	2/16/2017	4.02	3.23468	0.158	16.5	0.158	16.5
383.3339387	2/21/2017	3.311	3.23468	0.082	13.8	0.082	13.8
319.0390272	2/22/2017	3.264	3.23468	0.02	11.7	0.02	11.7
319.1386068	2/23/2017	3.081	3.23468	0.02	12.4	0.02	12.4
532.4185944	2/28/2017	3.087	3.23468	0.78	19.9	0.78	19.9
473.6349718	3/1/2017	3.092	3.55358	0.467	17.9	0.467	17.9
340.0500893	3/2/2017	3.014	3.55358	0.028	13.5	0.028	13.5
480.5026448	3/7/2017	3.702	3.55358	0.463	15.1	0.463	15.1
530.5459975	3/8/2017	3.498	3.55358	0.386	17.8	0.386	17.8
588.9632773	3/9/2017	3.586	3.55358	0.193	19.5	0.193	19.5
348.3853605	3/14/2017	3.825	3.55358	0.021	10.9	0.021	10.9
414.256115	3/15/2017	4.379	3.55358	0.043	11.3	0.043	11.3
387.0116952	3/16/2017	3.83	3.55358	0.016	12.1	0.016	12.1
440.5365225	3/21/2017	3.375	3.55358	0.151	15.5	0.151	15.5
469.7553706	3/22/2017	3.188	3.55358	0.768	16.9	0.768	16.9
523.3031746	3/23/2017	3.077	3.55358	0.492	19.9	0.492	19.9
286.1064355	3/28/2017	3.358	3.55358	0.016	10.2	0.016	10.2
529.7880416	3/29/2017	4.002	3.55358	0.173	15.7	0.173	15.7
486.2088395	3/30/2017	4.186	3.55358	0.027	13.9	0.027	13.9
364.8507723	4/4/2017	3.117	3.26913	0.035	14	0.035	14

309.3083739	4/5/2017	3.249	3.26913	0.015	11.4	0.015	11.4
299.2170573	4/6/2017	3.143	3.26913	0.015	11.4	0.015	11.4
555.2260591	4/11/2017	3.076	3.26913	0.143	21.5	0.143	21.5
562.4536532	4/12/2017	3.763	3.26913	0.022	17.9	0.022	17.9
483.0353861	4/13/2017	3.757	3.26913	0.016	15.4	0.016	15.4
241.0983078	4/18/2017	2.858	3.26913	0.015	10.1	0.015	10.1
249.3224235	4/19/2017	2.985	3.26913	0.015	10	0.015	10
570.2751054	4/20/2017	3.861	3.26913	0.31	17.4	0.31	17.4
286.440219	4/25/2017	3.09	3.26913	0.015	11.1	0.015	11.1
335.4768336	4/26/2017	3.376	3.26913	0.015	11.9	0.015	11.9
602.3620044	4/27/2017	3.193	3.26913	1.12	21.5	1.12	21.5
413.6428498	5/2/2017	2.828	2.92835	0.038	17.5	0.038	17.5
258.4374597	5/3/2017	2.947	2.92835	0.015	10.5	0.015	10.5
226.8468741	5/4/2017	3.311	2.92835	0.015	8.2	0.015	8.2
258.7754799	5/9/2017	2.869	2.92835	0.015	10.8	0.015	10.8
467.50704	5/10/2017	2.8	2.92835	1.72	18.3	1.72	18.3
459.6346138	5/11/2017	2.842	2.92835	0.092	19.3	0.092	19.3
327.1448817	5/16/2017	3.627	2.92835	0.015	10.8	0.015	10.8
413.4630894	5/18/2017	3.022	2.92835	0.105	16.3	0.105	16.3
370.3715604	5/23/2017	2.844	2.92835	0.415	15.2	0.415	15.2
530.1910555	5/24/2017	2.783	2.92835	0.143	22.7	0.143	22.7
372.7783676	5/25/2017	2.843	2.92835	0.022	15.7	0.022	15.7
183.3326072	5/30/2017	2.621	2.92835	0.087	8.3	0.087	8.3
186.372312	5/31/2017	2.576	2.92835	0.075	8.6	0.075	8.6
192.363768	6/1/2017	2.58	2.41167	0.04	8.9	0.04	8.9
391.4590836	6/6/2017	2.473	2.41167	0.08	18.9	0.08	18.9
414.554712	6/7/2017	2.42	2.41167	0.14	20.4	0.14	20.4
267.9702048	6/8/2017	2.526	2.41167	0.02	12.7	0.02	12.7
442.5724416	6/13/2017	2.432	2.41167	0.02	21.8	0.02	21.8
407.5818048	6/14/2017	2.556	2.41167	0.02	19.1	0.02	19.1
408.6021204	6/15/2017	2.423	2.41167	0.02	20.2	0.02	20.2
443.3574024	6/20/2017	2.346	2.41167	0.06	22.6	0.06	22.6
422.690382	6/21/2017	2.41	2.41167	0.13	20.9	0.13	20.9
459.4244124	6/22/2017	2.302	2.41167	0.03	23.9	0.03	23.9
240.2085132	6/27/2017	2.319	2.41167	0.02	12.4	0.02	12.4
240.680724	6/28/2017	2.305	2.41167	0.02	12.5	0.02	12.5
260.9192352	6/29/2017	2.314	2.41167	0.02	13.5	0.02	13.5
315.8444736	7/4/2017	2.298	2.21252	0.08	16.4	0.08	16.4
363.804561	7/5/2017	2.325	2.21252	0.462	18.3	0.462	18.3
268.3069323	7/11/2017	2.453	2.21252	0.015	13.1	0.015	13.1
416.7200095	8/1/2017	2.109	2.08839	0.192	23.5	0.192	23.5
322.117488	8/2/2017	2.09	2.08839	0.08	18.4	0.08	18.4
493.2383753	8/3/2017	2.082	2.08839	0.806	27.6	0.806	27.6
502.7520468	8/8/2017	2.083	2.08839	1.84	27.1	1.84	27.1
497.588953	8/9/2017	2.036	2.08839	0.404	28.9	0.404	28.9
331.9212414	8/10/2017	2.234	2.08839	0.015	17.8	0.015	17.8
526.1913749	8/15/2017	2.149	2.08839	0.559	28.8	0.559	28.8

341.5067787	8/16/2017	2.077	2.08839	0.015	19.7	0.015	19.7
408.63915	8/17/2017	2.085	2.08839	0.5	23	0.5	23
197.9230869	8/21/2017	2.079	2.08839	0.015	11.4	0.015	11.4
207.7162068	8/22/2017	2.108	2.08839	0.015	11.8	0.015	11.8
330.4837507	8/23/2017	2.107	2.08839	0.307	18.5	0.307	18.5
317.5116563	9/12/2017	2.058	2.09257	0.099	18.4	0.099	18.4
221.9500431	9/13/2017	2.161	2.09257	0.015	12.3	0.015	12.3
178.7358744	9/14/2017	2.018	2.09257	0.02	10.6	0.02	10.6
270.9368512	9/19/2017	2.149	2.09257	0.017	15.1	0.017	15.1
278.4697227	9/20/2017	2.063	2.09257	0.015	16.17	0.015	16.17
298.6989431	9/21/2017	2.073	2.09257	0.077	17.2	0.077	17.2
168.7074831	9/26/2017	2.061	2.09257	0.015	9.8	0.015	9.8
194.396226	9/27/2017	2.06	2.09257	0.015	11.3	0.015	11.3
186.5105892	9/28/2017	2.012	2.09257	0.015	11.1	0.015	11.1
351.6004305	10/3/2017	2.055	2.291	0.015	20.5	0.015	20.5
281.4531075	11/1/2017	2.325	NA	0.015	14.5	0.015	14.5
350.8231842	11/2/2017	2.37	NA	0.049	17.7	0.049	17.7
255.1031444	11/6/2017	2.507	NA	0.301	11.9	0.301	11.9
343.4371968	11/7/2017	2.368	NA	1.19	16.2	1.19	16.2
262.9916251	11/8/2017	2.331	NA	0.028	13.5	0.028	13.5
504.7145322	11/15/2017	3.505	NA	0.366	16.9	0.366	16.9
458.2640015	11/16/2017	2.846	NA	0.407	18.9	0.407	18.9
301.0808805	11/19/2017	2.837	NA	0.325	12.4	0.325	12.4
330.6635194	11/20/2017	3.084	NA	0.056	12.8	0.056	12.8
434.3143738	11/21/2017	3.656	NA	0.044	14.2	0.044	14.2
375.6583698	11/28/2017	3.878	NA	0.015	11.6	0.015	11.6
346.862685	11/29/2017	3.35	NA	0.015	12.4	0.015	12.4
517.058316	11/30/2017	3.56	NA	0.015	17.4	0.015	17.4
409.3996746	12/5/2017	2.905	3.134	0.098	16.8	0.098	16.8
581.6561863	12/6/2017	2.798	3.134	0.826	24.1	0.826	24.1
431.1926784	12/7/2017	2.72	3.134	0.108	18.9	0.108	18.9
314.3968414	12/12/2017	2.477	3.134	0.219	15	0.219	15
484.3208136	12/13/2017	2.468	3.134	1.13	22.4	1.13	22.4
450.4608806	12/14/2017	2.416	3.134	0.356	22	0.356	22
370.5125731	12/17/2017	3.756	3.134	0.628	11.2	0.628	11.2
505.7603515	12/20/2017	4.076	3.134	0.178	14.7	0.178	14.7
500.6024952	12/21/2017	3.502	3.134	1.24	15.9	1.24	15.9
231.0938273	12/26/2017	2.844	3.134	0.543	9.2	0.543	9.2
239.7611556	12/27/2017	2.707	3.134	0.42	10.2	0.42	10.2
294.6593057	12/28/2017	2.714	3.134	0.818	12.2	0.818	12.2
245.2277921	1/2/2018	3.077	3.624	0.156	9.4	0.156	9.4
203.2629971	1/3/2018	2.794	3.624	0.023	8.7	0.023	8.7
255.9601044	1/4/2018	2.73	3.624	0.442	10.8	0.442	10.8
394.2969104	1/9/2018	4.357	3.624	0.751	10.1	0.751	10.1
429.7639613	1/10/2018	4.047	3.624	0.233	12.5	0.233	12.5
488.5214047	1/11/2018	4.959	3.624	0.312	11.5	0.312	11.5
209.3895027	1/16/2018	3.297	3.624	0.015	7.6	0.015	7.6

226.2200397	1/17/2018	3.427	3.624	0.015	7.9	0.015	7.9
221.7980466	1/18/2018	3.686	3.624	0.015	7.2	0.015	7.2
226.5857904	1/23/2018	3.664	3.624	0.015	7.4	0.015	7.4
230.5231461	1/24/2018	3.831	3.624	0.015	7.2	0.015	7.2
241.4401644	1/25/2018	3.524	3.624	0.015	8.2	0.015	8.2
288.7985625	1/30/2018	4.375	3.624	0.015	7.9	0.015	7.9
256.3013772	1/31/2018	3.652	3.624	0.015	8.4	0.015	8.4
433.8047664	2/1/2018	3.726	3.74	1.76	12.2	1.76	12.2
265.6018116	2/6/2018	4.476	3.74	0.015	7.1	0.015	7.1
371.831027	2/7/2018	4.059	3.74	0.484	10.5	0.484	10.5
475.4747424	2/8/2018	3.736	3.74	1.06	14.2	1.06	14.2
301.3590695	2/13/2018	3.021	3.74	0.261	11.7	0.261	11.7
333.3962371	2/14/2018	3.196	3.74	0.608	11.9	0.608	11.9
317.7421906	2/15/2018	2.998	3.74	0.308	12.4	0.308	12.4
219.8915893	2/20/2018	3.461	3.74	0.018	7.6	0.018	7.6
247.7146633	2/21/2018	3.294	3.74	0.017	9	0.017	9
232.8798049	2/22/2018	2.989	3.74	0.042	9.3	0.042	9.3
320.2037916	2/27/2018	2.996	3.74	0.015	12.8	0.015	12.8
477.1397567	2/28/2018	3.186	3.74	0.457	17.5	0.457	17.5
467.8955506	3/1/2018	3.196	3.08394	0.154	17.4	0.154	17.4
384.1465716	3/6/2018	2.838	3.08394	1.43	14.8	1.43	14.8
334.4517725	3/7/2018	2.767	3.08394	0.393	14.1	0.393	14.1
429.0894972	3/8/2018	3.49	3.08394	0.742	14	0.742	14
345.45114	3/13/2018	3	3.08394	0.807	13	0.807	13
483.9915504	3/14/2018	3.005	3.08394	0.612	18.7	0.612	18.7
353.4791239	3/15/2018	2.938	3.08394	0.026	14.4	0.026	14.4
452.6957338	3/20/2018	2.624	3.08394	0.186	20.5	0.186	20.5
390.2512264	3/21/2018	2.621	3.08394	0.053	17.8	0.053	17.8
438.6572703	3/22/2018	2.931	3.08394	0.045	17.9	0.045	17.9
694.5531734	3/27/2018	3.729	3.08394	0.533	21.8	0.533	21.8
741.9287686	3/28/2018	3.478	3.08394	0.478	25.1	0.478	25.1
474.2308314	3/29/2018	3.174	3.08394	0.015	17.9	0.015	17.9
385.721664	4/3/2018	2.98	3.5245	0.12	15.4	0.12	15.4
549.5934733	4/4/2018	3.306	3.5245	0.533	19.4	0.533	19.4
531.903516	4/5/2018	3.56	3.5245	0.015	17.9	0.015	17.9
566.9058955	4/10/2018	3.506	3.5245	0.288	19.1	0.288	19.1
725.049576	4/11/2018	3.534	3.5245	0.7	23.9	0.7	23.9
671.0012302	4/12/2018	3.557	3.5245	0.519	22.1	0.519	22.1
425.5922016	4/15/2018	4.92	3.5245	0.072	10.3	0.072	10.3
603.4125942	4/16/2018	5.265	3.5245	0.442	13.3	0.442	13.3
590.5414889	4/17/2018	4.573	3.5245	0.684	14.8	0.684	14.8
272.13832	4/24/2018	2.833	3.5245	0.018	11.5	0.018	11.5
301.5945244	4/25/2018	2.797	3.5245	0.029	12.9	0.029	12.9
434.1614265	4/26/2018	2.705	3.5245	0.945	18.3	0.945	18.3
478.4953236	5/1/2018	2.66	2.55	0.069	21.5	0.069	21.5
373.262121	5/2/2018	2.71	2.55	0.015	16.5	0.015	16.5
322.006566	5/3/2018	2.66	2.55	0.015	14.5	0.015	14.5

550.571355	5/8/2018	2.67	2.55	0.125	24.6	0.125	24.6
453.9081112	5/9/2018	2.661	2.55	0.053	20.4	0.053	20.4
375.6913545	5/10/2018	2.695	2.55	0.015	16.7	0.015	16.7
287.1764075	5/15/2018	2.683	2.55	0.034	12.8	0.034	12.8
240.8323369	5/16/2018	2.573	2.55	0.023	11.2	0.023	11.2
227.730789	5/17/2018	2.546	2.55	0.025	10.7	0.025	10.7
228.7512797	5/20/2018	2.657	2.55	0.223	10.1	0.223	10.1
496.714554	5/22/2018	2.513	2.55	1.7	22	1.7	22
306.9655762	5/23/2018	2.433	2.55	0.028	15.1	0.028	15.1
244.1749338	5/29/2018	2.478	2.55	0.015	11.8	0.015	11.8
432.3225816	5/30/2018	2.444	2.55	1.11	20.1	1.11	20.1
568.6573622	5/31/2018	2.409	2.55	0.704	27.6	0.704	27.6
406.3225816	6/5/2018	2.386	2.47	0.019	20.4	0.019	20.4
273.1086873	6/6/2018	2.423	2.47	0.015	13.5	0.015	13.5
383.7866756	6/7/2018	2.381	2.47	0.627	18.7	0.627	18.7
225.4209426	6/12/2018	2.646	2.47	0.015	10.2	0.015	10.2
268.2179862	6/13/2018	2.722	2.47	0.015	11.8	0.015	11.8
231.7475248	6/14/2018	2.667	2.47	0.019	10.4	0.019	10.4
247.5974196	6/19/2018	3.03	2.47	0.298	9.5	0.298	9.5
202.379274	6/20/2018	2.35	2.47	0.826	9.5	0.826	9.5
524.34414	6/21/2018	2.206	2.47	12.6	15.9	12.6	15.9
346.4417318	6/25/2018	3.088	2.47	0.752	12.7	0.752	12.7
247.1715792	6/26/2018	2.184	2.47	0.27	13.3	0.27	13.3
225.4481143	6/27/2018	2.124	2.47	0.227	12.5	0.227	12.5
320.3382991	6/28/2018	2.261	2.47	0.788	16.2	0.788	16.2
245.0613924	7/1/2018	2.532	2.2261	0.405	11.2	0.405	11.2
418.2705156	7/4/2018	2.359	2.2261	4.56	16.7	4.56	16.7
304.6090925	7/5/2018	2.376	2.2261	0.272	15.1	0.272	15.1
445.1873652	7/10/2018	2.162	2.2261	5.99	18.7	5.99	18.7
231.3031446	7/12/2018	2.202	2.2261	0.095	12.5	0.095	12.5
202.7061353	7/16/2018	2.214	2.2261	0.178	10.8	0.178	10.8
283.183866	7/18/2018	2.185	2.2261	1.84	13.7	1.84	13.7
172.3454745	7/24/2018	2.165	2.2261	0.045	9.5	0.045	9.5
176.6637347	7/25/2018	2.117	2.2261	0.106	9.9	0.106	9.9
178.908479	7/26/2018	2.173	2.2261	0.072	9.8	0.072	9.8
187.1017284	7/31/2018	2.153	2.2261	0.12	10.3	0.12	10.3
204.3296497	8/1/2018	2.177	2.15	0.454	10.8	0.454	10.8
257.962872	8/2/2018	2.12	2.15	1.69	12.9	1.69	12.9
230.2112551	8/7/2018	2.156	2.15	0.303	12.5	0.303	12.5
331.1407008	8/8/2018	2.121	2.15	4.22	14.5	4.22	14.5
288.8735808	8/9/2018	2.209	2.15	1.48	14.2	1.48	14.2
140.764655	8/14/2018	2.017	2.15	0.268	8.1	0.268	8.1
281.33322	8/15/2018	2.212	2.15	4.15	11.1	4.15	11.1
280.641834	8/21/2018	2.178	2.15	3.05	12.4	3.05	12.4
225.3171096	8/22/2018	2.134	2.15	1.46	11.2	1.46	11.2
238.2084144	8/23/2018	2.046	2.15	1.96	12	1.96	12
201.9661104	8/28/2018	2.168	2.15	1.07	10.1	1.07	10.1

192.460929	8/29/2018	2.05	2.15	0.857	10.4	0.857	10.4
285.556596	8/30/2018	2.026	2.15	5.6	11.3	5.6	11.3
208.21644	9/3/2018	2.28	2.37	1.35	9.6	1.35	9.6
194.4039989	9/4/2018	2.184	2.37	0.373	10.3	0.373	10.3
269.7501276	9/5/2018	2.103	2.37	3.38	12	3.38	12
187.4107754	9/25/2018	2.422	2.37	0.978	8.3	0.978	8.3
184.4927262	9/26/2018	2.371	2.37	1.73	7.6	1.73	7.6
233.5803816	9/27/2018	2.237	2.37	4.02	8.5	4.02	8.5
277.1335296	10/2/2018	2.564	2.46	4.66	8.3	4.66	8.3
396.0604284	10/3/2018	2.522	2.46	7.33	11.5	7.33	11.5
414.849114	10/4/2018	2.43	2.46	8.47	12	8.47	12
262.4378658	10/7/2018	2.651	2.46	3.57	8.3	3.57	8.3
251.6601672	10/8/2018	2.668	2.46	3.11	8.2	3.11	8.2
201.656196	10/23/2018	2.121	2.46	3.1	8.3	3.1	8.3
258.36903	10/24/2018	2.174	2.46	4.25	10	4.25	10
352.872072	10/25/2018	2.92	2.46	2.89	11.6	2.89	11.6
225.8412202	10/30/2018	2.567	2.46	0.549	10	0.549	10
261.5703056	10/31/2018	2.674	2.46	0.829	10.9	0.829	10.9
292.7719303	11/1/2018	3.313	2.954	0.896	9.7	0.896	9.7
258.1940902	11/6/2018	3.078	2.954	0.358	9.7	0.358	9.7
268.8833347	11/7/2018	2.904	2.954	0.402	10.7	0.402	10.7
261.8537822	11/8/2018	2.648	2.954	0.857	11	0.857	11
245.6734817	11/13/2018	2.409	2.954	0.928	11.3	0.928	11.3
306.975384	11/14/2018	2.487	2.954	3.2	11.6	3.2	11.6
346.5752886	11/15/2018	2.551	2.954	4.19	12.1	4.19	12.1
289.975545	11/18/2018	2.727	2.954	3.15	9.6	3.15	9.6
233.1248508	11/19/2018	2.498	2.954	1.69	9.5	1.69	9.5
238.555275	11/20/2018	2.335	2.954	1.65	10.6	1.65	10.6
289.9839684	11/27/2018	3.535	2.954	0.636	9.2	0.636	9.2
387.0400512	11/28/2018	3.296	2.954	2.48	11.6	2.48	11.6
374.4983592	11/29/2018	3.114	2.954	2.72	11.7	2.72	11.7
243.7207374	12/4/2018	2.593	2.94	1.17	10.1	1.17	10.1
229.0257408	12/5/2018	2.524	2.94	1.38	9.5	1.38	9.5
224.700033	12/6/2018	2.465	2.94	1.03	9.9	1.03	9.9
219.2813682	12/11/2018	2.719	2.94	1.67	8	1.67	8
215.781654	12/12/2018	2.735	2.94	1.26	8.2	1.26	8.2
270.0098352	12/13/2018	2.753	2.94	2.96	8.8	2.96	8.8
288.5426496	12/16/2018	3.516	2.94	2.44	7.4	2.44	7.4
261.1474176	12/19/2018	2.878	2.94	1.98	8.9	1.98	8.9
265.0822296	12/21/2018	2.908	2.94	2.33	8.6	2.33	8.6
214.3806174	12/25/2018	2.791	2.94	2.81	6.4	2.81	6.4
226.2497718	12/26/2018	2.743	2.94	3.29	6.6	3.29	6.6
300.3651	12/27/2018	2.625	2.94	6.62	7.1	6.62	7.1
205.499268	1/1/2019	3.042	2.88	1.4	6.7	1.4	6.7
187.438581	1/2/2019	2.827	2.88	1.25	6.7	1.25	6.7
241.6654278	1/3/2019	2.889	2.88	1.93	8.1	1.93	8.1
381.123405	1/8/2019	3.225	2.88	1.27	12.9	1.27	12.9

492.8793216	1/9/2019	3.452	2.88	1.22	15.9	1.22	15.9
484.8658326	1/10/2019	3.347	2.88	1.17	16.2	1.17	16.2
297.2376	1/15/2019	2.64	2.88	1.9	11.6	1.9	11.6
416.40786	1/16/2019	2.67	2.88	4.5	14.2	4.5	14.2
604.688364	1/17/2019	2.562	2.88	10.1	18.2	10.1	18.2
236.7951347	1/22/2019	2.657	2.88	1.886	8.8	1.886	8.8
318.221874	1/23/2019	2.895	2.88	2.68	10.5	2.68	10.5
365.3396214	1/24/2019	2.743	2.88	2.77	13.2	2.77	13.2
304.1451216	1/29/2019	2.491	2.88	3.64	11	3.64	11
336.323427	1/30/2019	2.497	2.88	2.75	13.4	2.75	13.4
355.0958496	1/31/2019	2.487	2.88	3.02	14.1	3.02	14.1
223.8309216	2/5/2019	2.652	2.93	1.52	8.6	1.52	8.6
210.9328614	2/6/2019	2.547	2.93	1.23	8.7	1.23	8.7
428.936208	2/7/2019	2.426	2.93	10.3	10.9	10.3	10.9
226.6904574	2/12/2019	2.657	2.93	1.83	8.4	1.83	8.4
268.183125	2/13/2019	3.125	2.93	1.39	8.9	1.39	8.9
328.705254	2/14/2019	3.326	2.93	2.15	9.7	2.15	9.7
264.0450922	2/19/2019	3.393	2.93	0.531	8.8	0.531	8.8
542.649189	2/20/2019	3.335	2.93	5.71	13.8	5.71	13.8
679.57656	2/21/2019	3.134	2.93	9.9	16.1	9.9	16.1
431.941527	2/26/2019	2.895	2.93	2.79	15.1	2.79	15.1
337.8565775	2/27/2019	2.719	2.93	0.599	14.3	0.599	14.3
351.5386728	3/5/2019	2.506	2.68	4.52	12.3	4.52	12.3
439.42626	3/6/2019	2.509	2.68	6.4	14.6	6.4	14.6
350.297514	3/7/2019	2.655	2.68	1.62	14.2	1.62	14.2
660.2637888	3/12/2019	3.528	2.68	6.74	15.7	6.74	15.7
440.9361169	3/13/2019	3.126	2.68	0.613	16.3	0.613	16.3
422.1290333	3/14/2019	2.952	2.68	0.946	16.2	0.946	16.2
352.466748	3/19/2019	2.658	2.68	2.2	13.7	2.2	13.7
406.957806	3/20/2019	2.615	2.68	1.86	16.8	1.86	16.8
275.6120968	3/21/2019	2.618	2.68	0.323	12.3	0.323	12.3
441.316104	3/26/2019	2.515	2.68	2.64	18.4	2.64	18.4
305.2709716	3/27/2019	2.451	2.68	0.134	14.8	0.134	14.8
288.4589994	3/28/2019	2.47	2.68	0.103	13.9	0.103	13.9
272.4383932	4/2/2019	2.339	2.76	0.766	13.2	0.766	13.2
340.475913	4/3/2019	2.313	2.76	1.15	16.5	1.15	16.5
369.7871933	4/4/2019	2.278	2.76	0.264	19.2	0.264	19.2
346.6340856	4/9/2019	2.553	2.76	0.28	16	0.28	16
457.8269271	4/11/2019	2.815	2.76	0.301	19.2	0.301	19.2
387.6894787	4/16/2019	3.091	2.76	0.139	14.9	0.139	14.9
443.8649081	4/17/2019	2.943	2.76	0.084	18	0.084	18
438.3441617	4/18/2019	2.987	2.76	0.196	17.4	0.196	17.4
331.423727	4/23/2019	2.828	2.76	0.252	13.8	0.252	13.8
485.4381651	4/24/2019	2.765	2.76	0.251	20.8	0.251	20.8
453.8749597	4/25/2019	2.639	2.76	0.022	20.6	0.022	20.6
432.8661911	4/30/2019	2.507	2.76	0.403	20.3	0.403	20.3
590.3750475	5/1/2019	2.525	2.47	0.335	27.7	0.335	27.7

577.9770287	5/2/2019	2.449	2.47	0.198	28.1	0.198	28.1
487.382511	5/7/2019	2.471	2.47	1.65	22	1.65	22
594.3931344	5/8/2019	2.586	2.47	2.36	25.2	2.36	25.2
526.22064	5/9/2019	2.4	2.47	1.19	25.1	1.19	25.1
323.0375568	5/14/2019	2.296	2.47	6.17	10.7	6.17	10.7
421.7558016	5/15/2019	2.324	2.47	8.56	13.2	8.56	13.2
590.882328	5/16/2019	2.567	2.47	10.4	17.2	10.4	17.2
703.590756	5/21/2019	2.474	2.47	15.7	18.4	15.7	18.4
440.698944	5/22/2019	2.359	2.47	2.3	20.1	2.3	20.1
323.6911626	5/23/2019	2.405	2.47	0.338	15.8	0.338	15.8
252.7796204	5/28/2019	2.423	2.47	0.109	12.4	0.109	12.4
462.2254848	5/29/2019	2.448	2.47	2.84	19.8	2.84	19.8
413.1921645	5/30/2019	2.325	2.47	0.109	21.2	0.109	21.2
509.8989264	6/4/2019	2.32	2.35	0.753	25.6	0.753	25.6
534.2828513	6/5/2019	2.326	2.35	0.342	27.2	0.342	27.2
586.148544	6/6/2019	2.4	2.35	0.284	29	0.284	29
516.9910539	6/11/2019	2.381	2.35	0.335	25.7	0.335	25.7
510.8707449	6/12/2019	2.439	2.35	0.115	25	0.115	25
431.6450734	6/13/2019	2.297	2.35	0.032	22.5	0.032	22.5
337.0054305	6/18/2019	2.315	2.35	0.155	17.3	0.155	17.3
534.763719	6/19/2019	2.319	2.35	0.05	27.6	0.05	27.6
470.553642	6/20/2019	2.21	2.35	0.03	25.5	0.03	25.5
396.2743911	6/25/2019	2.335	2.35	0.049	20.3	0.049	20.3
503.6409907	6/26/2019	2.256	2.35	0.068	26.7	0.068	26.7
468.5208671	6/27/2019	2.226	2.35	0.037	25.2	0.037	25.2
304.8395267	6/30/2019	2.353	2.35	0.034	15.5	0.034	15.5
243.1116839	7/1/2019	2.154	2.17	0.033	13.5	0.033	13.5
308.520369	7/2/2019	2.771	2.17	1.35	12	1.35	12
219.0566803	7/9/2019	2.157	2.17	0.977	11.2	0.977	11.2
203.6839836	7/10/2019	2.18	2.17	0.803	10.4	0.803	10.4
225.8777578	7/11/2019	2.166	2.17	0.904	11.6	0.904	11.6
223.4133378	7/14/2019	2.253	2.17	3.29	8.6	3.29	8.6
226.3789584	7/16/2019	2.114	2.17	2.74	10.1	2.74	10.1
259.145901	7/17/2019	2.121	2.17	4.75	9.9	4.75	9.9
213.081162	7/23/2019	2.147	2.17	2.2	9.7	2.2	9.7
245.29608	7/24/2019	2.15	2.17	4.18	9.5	4.18	9.5
227.8417944	7/25/2019	2.141	2.17	2.96	9.8	2.96	9.8
229.8367224	7/30/2019	2.133	2.17	1.72	11.2	1.72	11.2
226.2150774	7/31/2019	2.151	2.17	1.71	10.9	1.71	10.9
207.5549112	8/1/2019	2.067	2.12	1.34	10.7	1.34	10.7
218.230695	8/6/2019	2.085	2.12	1.25	11.3	1.25	11.3
225.2698218	8/7/2019	2.089	2.12	1.53	11.4	1.53	11.4
224.5729314	8/8/2019	2.089	2.12	1.59	11.3	1.59	11.3
240.1775885	8/15/2019	2.076	2.12	0.972	12.9	0.972	12.9
196.4681656	8/20/2019	2.077	2.12	0.542	10.8	0.542	10.8
242.2679094	8/21/2019	2.147	2.12	1.63	11.9	1.63	11.9
238.9223351	8/22/2019	2.123	2.12	0.894	12.6	0.894	12.6

225.9652944	8/25/2019	2.273	2.12	1.22	10.7	1.22	10.7
217.587264	8/27/2019	2.104	2.12	0.7	11.7	0.7	11.7
231.0123288	8/28/2019	2.134	2.12	0.88	12.1	0.88	12.1
235.8525312	9/2/2019	2.288	2.441	3.76	8.6	3.76	8.6
204.5775312	9/3/2019	2.198	2.441	1.26	9.9	1.26	9.9
230.480904	9/10/2019	2.36	2.441	1.11	10.6	1.11	10.6
243.7389603	9/11/2019	2.277	2.441	0.535	12.3	0.535	12.3
269.778984	9/12/2019	2.278	2.441	1.4	12.8	1.4	12.8
293.9556766	9/17/2019	2.548	2.441	0.633	13.2	0.633	13.2
374.479344	9/18/2019	2.544	2.441	2.55	15.1	2.55	15.1
275.9354052	9/19/2019	2.401	2.441	2.28	11.5	2.28	11.5
284.3815901	9/24/2019	2.576	2.441	0.037	13.2	0.037	13.2
436.1943182	9/25/2019	2.473	2.441	0.049	21.1	0.049	21.1
501.6756697	9/26/2019	2.666	2.441	0.063	22.5	0.063	22.5
360.4928137	9/30/2019	2.561	2.441	0.278	16.6	0.278	16.6
394.4317932	10/1/2019	2.391	2.58	1.08	18.7	1.08	18.7
340.2559872	10/2/2019	2.361	2.58	3.38	13.9	3.38	13.9
268.7557828	10/6/2019	2.571	2.58	0.734	11.8	0.734	11.8
265.95426	10/7/2019	2.75	2.58	0.196	11.4	0.196	11.4
499.0093884	10/22/2019	3.385	2.58	0.076	17.6	0.076	17.6
458.9886974	10/23/2019	2.938	2.58	0.032	18.7	0.032	18.7
403.5585888	10/24/2019	2.76	2.58	0.032	17.5	0.032	17.5
301.4381911	10/29/2019	2.332	2.58	0.199	15.3	0.199	15.3
377.0298828	10/30/2019	2.346	2.58	1.07	18.2	1.07	18.2
362.4410294	10/31/2019	2.269	2.58	0.153	19	0.153	19
286.7249966	11/5/2019	2.232	2.52	0.303	15.1	0.303	15.1
347.6172882	11/6/2019	2.282	2.52	0.065	18.2	0.065	18.2
308.3957861	11/7/2019	2.264	2.52	0.033	16.3	0.033	16.3
301.7105255	11/12/2019	2.301	2.52	0.022	15.7	0.022	15.7
401.9089368	11/13/2019	2.254	2.52	1.48	19.9	1.48	19.9
333.3875385	11/14/2019	2.281	2.52	0.025	17.5	0.025	17.5
403.6107138	11/19/2019	3.019	2.52	0.03	16	0.03	16
358.9805799	11/20/2019	2.829	2.52	0.015	15.2	0.015	15.2
360.0025218	11/21/2019	2.598	2.52	0.015	16.6	0.015	16.6
273.4093777	11/24/2019	2.881	2.52	0.079	11.3	0.079	11.3
250.5751749	11/25/2019	2.679	2.52	0.015	11.2	0.015	11.2
302.1103701	11/26/2019	2.607	2.52	0.095	13.8	0.095	13.8
279.2957663	12/3/2019	2.311	2.94	0.091	14.4	0.091	14.4
279.5549819	12/4/2019	2.423	2.94	0.034	13.8	0.034	13.8
321.619198	12/5/2019	2.351	2.94	0.103	16.3	0.103	16.3
379.3479024	12/10/2019	2.564	2.94	0.24	17.5	0.24	17.5
400.915843	12/11/2019	2.566	2.94	0.034	18.7	0.034	18.7
421.6413768	12/12/2019	2.884	2.94	0.03	17.5	0.03	17.5
345.3212028	12/16/2019	2.716	2.94	0.445	14.8	0.445	14.8
394.6689828	12/17/2019	2.595	2.94	0.136	18.1	0.136	18.1
390.665983	12/18/2019	2.553	2.94	0.148	18.2	0.148	18.2
470.6262	12/22/2019	4.125	2.94	0.08	13.6	0.08	13.6

274.1828626	12/25/2019	2.983	2.94	0.321	10.7	0.321	10.7
360.479403	12/26/2019	2.853	2.94	2.25	12.9	2.25	12.9
296.219703	12/30/2019	2.65	2.94	0.503	12.9	0.503	12.9
299.309623	12/31/2019	2.833	2.94	0.568	12.1	0.568	12.1
225.1342968	1/2/2020	2.947	3.42	0.06	9.1	0.06	9.1
473.3852805	1/7/2020	3.531	3.42	0.175	15.9	0.175	15.9
527.2237919	1/8/2020	3.607	3.42	0.126	17.4	0.126	17.4
591.286351	1/9/2020	3.449	3.42	0.156	20.4	0.156	20.4
486.7551679	1/14/2020	3.341	3.42	0.169	17.3	0.169	17.3
451.8507917	1/15/2020	3.228	3.42	0.084	16.7	0.084	16.7
430.3983935	1/16/2020	3.201	3.42	0.022	16.1	0.022	16.1
464.0624615	1/21/2020	3.271	3.42	0.111	16.9	0.111	16.9
572.7685569	1/22/2020	3.545	3.42	0.073	19.3	0.073	19.3
671.5293274	1/23/2020	3.676	3.42	0.904	21	0.904	21
495.398477	1/28/2020	3.681	3.42	0.037	16.1	0.037	16.1
446.2545516	1/29/2020	3.445	3.42	0.032	15.5	0.032	15.5
462.267018	1/30/2020	3.335	3.42	0.02	16.6	0.02	16.6
432.6980067	2/3/2020	3.401	3.64	0.255	15	0.255	15
515.0403196	2/4/2020	3.874	3.64	0.041	15.9	0.041	15.9
650.6580604	2/6/2020	6.699	3.64	0.046	11.6	0.046	11.6
475.0850976	2/11/2020	3.512	3.64	0.12	16.1	0.12	16.1
467.892715	2/12/2020	3.261	3.64	0.204	17	0.204	17
530.757183	2/13/2020	3.35	3.64	0.097	18.9	0.097	18.9
339.8396544	2/18/2020	3.04	3.64	0.104	13.3	0.104	13.3
454.5344702	2/19/2020	2.972	3.64	0.538	17.8	0.538	17.8
510.828336	2/20/2020	2.82	3.64	0.52	21.2	0.52	21.2
287.6027399	2/25/2020	2.759	3.64	0.399	12.1	0.399	12.1
317.188548	2/26/2020	2.7	3.64	0.186	13.9	0.186	13.9
364.0745018	2/27/2020	2.651	3.64	0.867	15.6	0.867	15.6
359.5012044	3/3/2020	3.17	2.83	0.098	13.5	0.098	13.5
358.4384549	3/4/2020	3.062	2.83	0.036	14	0.036	14
409.3544218	3/5/2020	3.288	2.83	0.028	14.9	0.028	14.9
369.8903424	3/10/2020	2.944	2.83	0.165	14.9	0.165	14.9
295.6655934	3/11/2020	2.865	2.83	0.074	12.3	0.074	12.3
290.0876846	3/12/2020	2.808	2.83	0.087	12.3	0.087	12.3
325.9525536	3/17/2020	2.616	2.83	1.14	13.8	1.14	13.8
293.9749753	3/18/2020	2.626	2.83	0.723	12.7	0.723	12.7
269.364436	3/19/2020	2.594	2.83	0.251	12.2	0.251	12.2
364.5789717	3/24/2020	2.605	2.83	0.981	15.8	0.981	15.8
316.5470352	3/25/2020	2.614	2.83	1.02	13.5	1.02	13.5
294.4468859	3/26/2020	2.546	2.83	0.567	13.3	0.567	13.3
365.423355	3/31/2020	2.825	2.83	1.11	14.4	1.11	14.4
325.0226269	4/1/2020	2.741	2.6	0.518	13.7	0.518	13.7
311.8634163	4/2/2020	2.715	2.6	0.573	13.2	0.573	13.2
382.5748986	4/7/2020	2.567	2.6	3.07	14.8	3.07	14.8
398.2643568	4/8/2020	2.532	2.6	2.06	16.8	2.06	16.8
401.377095	4/9/2020	2.575	2.6	3.69	15	3.69	15

328.8782256	4/14/2020	2.477	2.6	2.22	13.7	2.22	13.7
354.7475712	4/15/2020	2.508	2.6	2.36	14.6	2.36	14.6
391.866993	4/16/2020	2.555	2.6	1.49	16.9	1.49	16.9
361.2888	4/21/2020	2.375	2.6	2.84	15.4	2.84	15.4
364.956732	4/22/2020	2.898	2.6	1.3	13.8	1.3	13.8
322.9209886	4/23/2020	2.791	2.6	0.473	13.4	0.473	13.4
376.2781152	4/28/2020	2.587	2.6	1.34	16.1	1.34	16.1
400.8136446	4/29/2020	2.507	2.6	4.17	15	4.17	15
389.977983	4/30/2020	2.565	2.6	1.53	16.7	1.53	16.7
308.2178772	5/5/2020	2.715	2.72	0.312	13.3	0.312	13.3
317.7327413	5/6/2020	2.869	2.72	0.179	13.1	0.179	13.1
306.8096682	5/7/2020	2.702	2.72	0.315	13.3	0.315	13.3
400.73283	5/12/2020	3.11	2.72	7.85	7.6	7.85	7.6
472.870494	5/13/2020	2.589	2.72	15.1	6.8	15.1	6.8
471.767112	5/14/2020	2.481	2.72	15.1	7.7	15.1	7.7
409.8867306	5/19/2020	2.599	2.72	9.01	9.9	9.01	9.9
465.599682	5/20/2020	2.621	2.72	11.9	9.4	11.9	9.4
555.228828	5/21/2020	2.541	2.72	18.5	7.7	18.5	7.7
449.204076	5/26/2020	2.602	2.72	12.5	8.2	12.5	8.2
509.162004	5/27/2020	2.609	2.72	13.5	9.9	13.5	9.9
521.81712	5/28/2020	2.64	2.72	13.3	10.4	13.3	10.4
605.901	6/2/2020	2.906	3.035	15.1	9.9	15.1	9.9
602.872746	6/3/2020	2.791	3.035	15.3	10.6	15.3	10.6
411.6410496	6/4/2020	2.624	3.035	7.31	11.5	7.31	11.5
639.671328	6/9/2020	3.306	3.035	12.9	10.3	12.9	10.3
448.040646	6/10/2020	2.955	3.035	7.78	10.4	7.78	10.4
602.621712	6/11/2020	3.036	3.035	12.8	11	12.8	11
474.4157292	6/16/2020	3.689	3.035	6.52	8.9	6.52	8.9
520.285896	6/17/2020	3.354	3.035	9	9.6	9	9.6
488.2830642	6/18/2020	3.163	3.035	8.01	10.5	8.01	10.5
321.9513552	6/23/2020	2.868	3.035	2.66	10.8	2.66	10.8
233.5525677	6/24/2020	2.859	3.035	0.495	9.3	0.495	9.3
228.6358792	6/25/2020	2.753	3.035	0.158	9.8	0.158	9.8
253.6304755	6/29/2020	2.572	3.035	0.024	11.8	0.024	11.8
308.0377832	6/30/2020	2.571	3.035	0.166	14.2	0.166	14.2
377.0333356	7/1/2020	2.649	2.45	0.066	17	0.066	17
399.5270745	7/7/2020	2.579	2.45	0.075	18.5	0.075	18.5
364.8330331	7/8/2020	2.502	2.45	0.084	17.4	0.084	17.4
270.7291352	7/9/2020	2.471	2.45	0.037	13.1	0.037	13.1
406.072932	7/14/2020	2.74	2.45	3.37	14.4	3.37	14.4
322.831859	7/15/2020	2.424	2.45	0.469	15.5	0.469	15.5
272.5713161	7/16/2020	2.401	2.45	0.512	13.1	0.512	13.1
353.5366449	7/21/2020	2.455	2.45	0.367	16.9	0.367	16.9
241.09689	7/22/2020	2.375	2.45	0.272	11.9	0.272	11.9
292.5198455	7/23/2020	2.333	2.45	0.034	15	0.034	15
307.439088	7/28/2020	2.36	2.45	0.02	15.6	0.02	15.6
366.9521604	7/29/2020	2.363	2.45	0.02	18.6	0.02	18.6

316.9284651	7/30/2020	2.301	2.45	0.015	16.5	0.015	16.5
311.5148627	8/11/2020	2.289	2.295	0.018	16.3	0.018	16.3
353.2697566	8/12/2020	2.282	2.295	0.062	18.5	0.062	18.5
280.7904528	8/13/2020	2.288	2.295	0.015	14.7	0.015	14.7
297.6250931	8/18/2020	2.311	2.295	0.042	15.4	0.042	15.4
348.0862464	8/19/2020	2.304	2.295	0.015	18.1	0.015	18.1
259.7369401	8/20/2020	2.254	2.295	0.017	13.8	0.017	13.8
301.833824	8/25/2020	2.218	2.295	0.017	16.3	0.017	16.3
281.6131104	8/26/2020	2.148	2.295	0.02	15.7	0.02	15.7
318.5831628	8/27/2020	2.205	2.295	0.024	17.3	0.024	17.3
260.8882438	9/15/2020	2.346	2.37	0.134	13.2	0.134	13.2
316.6846452	9/16/2020	2.31	2.37	0.038	16.4	0.038	16.4
276.1887744	9/17/2020	2.31	2.37	0.036	14.3	0.036	14.3
309.787632	9/22/2020	2.345	2.37	0.04	15.8	0.04	15.8
374.6400975	9/23/2020	2.575	2.37	0.045	17.4	0.045	17.4
306.474567	9/24/2020	2.45	2.37	0.099	14.9	0.099	14.9
183.3440413	9/28/2020	2.486	2.37	0.043	8.8	0.043	8.8
232.9141407	9/29/2020	2.419	2.37	0.045	11.5	0.045	11.5
197.1732959	9/30/2020	2.398	2.37	0.059	9.8	0.059	9.8
199.7735244	10/6/2020	2.374	2.68	0.29	9.8	0.29	9.8
165.6971184	10/7/2020	2.354	2.68	0.24	8.2	0.24	8.2
186.328944	10/8/2020	2.32	2.68	0.53	9.1	0.53	9.1
274.779648	10/11/2020	2.88	2.68	0.04	11.4	0.04	11.4
260.0320594	10/12/2020	2.724	2.68	0.046	11.4	0.046	11.4
337.3624742	10/27/2020	2.568	2.68	0.052	15.7	0.052	15.7
358.1953939	10/28/2020	2.548	2.68	0.056	16.8	0.056	16.8
269.2453908	10/29/2020	2.51	2.68	0.062	12.8	0.062	12.8
359.3889563	11/3/2020	2.883	3.05	0.147	14.8	0.147	14.8
337.7727022	11/4/2020	2.924	3.05	0.051	13.8	0.051	13.8
296.9462338	11/5/2020	2.981	3.05	0.044	11.9	0.044	11.9
411.4354186	11/8/2020	2.731	3.05	0.064	18	0.064	18
444.3234246	11/11/2020	2.755	3.05	0.038	19.3	0.038	19.3
376.4131231	11/12/2020	2.713	3.05	0.036	16.6	0.036	16.6
313.537	12/8/2020	2.883	3.05	0.14	12.9	0.14	12.9

ATTACHMENT C

REVISED PERMIT ACTION LEVEL ALTERNATIVE 2

Data, Controls, Numeric Output

significant digits to display

3

353 Daily

129,000 Annual

Fix Random number Seed

Action Level based on 109 data points Over 1800 days

Please select Data file

Browse... WA0020893DAYmp002_DMR(alt2).csv

Upload complete

Earliest Data to consider for calculation

2016-01-05

Latest Data to consider for calculation

2020-12-31

Samples per month (per year/12)

1 8 30

1 4 7 10 13 16 19 22 25 28 30

Thousands of iterations

4 100

4 14 24 34 44 54 64 74 84 94 100

Confidence Level Needed

90 99

90 91 92 93 94 95 96 97 98 99

If Date is not second field input, data assumed to be sequential months starting in Jan 2015

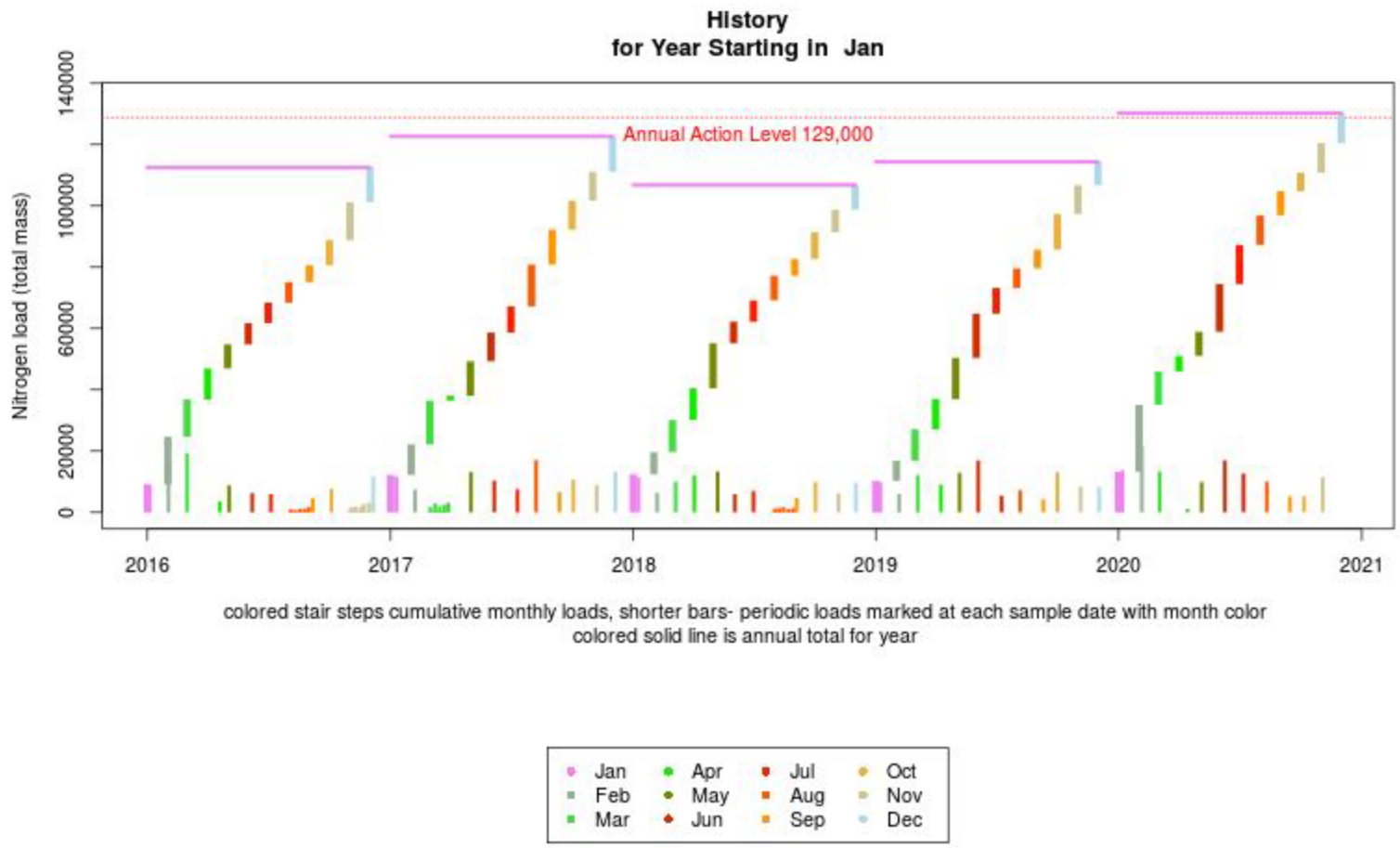
WA0020893DAYmp002_DMR(alt2).csv

DataTable Summary Individual Annual Version Help

first month of year

Jan

Extrapolate data to ends of year



load	POS	Q2	Qave	AMM	NIT	Ammonia	Nitrate...Nitrite
297.7915428	1/5/2016	2.511	3.12294	0.02	14.2	0.02	14.2
540.1277568	2/2/2016	2.848	2.97866	0.04	22.7	0.04	22.7
392.567136	3/1/2016	2.92	3.07742	0.02	16.1	0.02	16.1
256.862826	4/19/2016	2.295	2.43637	0.02	13.4	0.02	13.4
252.483492	5/3/2016	2.29	2.22839	0.02	13.2	0.02	13.2
224.899776	6/7/2016	2.12	2.1628	0.02	12.7	0.02	12.7
214.6772712	7/5/2016	2.254	2.09394	0.02	11.4	0.02	11.4
187.8928608	8/2/2016	2.026	2.05555	0.02	11.1	0.02	11.1
241.3519272	8/3/2016	2.073	2.05555	0.06	13.9	0.06	13.9
202.2339912	8/4/2016	2.069	2.05555	0.02	11.7	0.02	11.7
221.830656	8/9/2016	2.078	2.05555	0.4	12.4	0.4	12.4
221.0960688	8/10/2016	2.033	2.05555	0.04	13	0.04	13
157.1262672	8/11/2016	1.979	2.05555	0.02	9.5	0.02	9.5
167.1816384	8/16/2016	2.128	2.05555	0.02	9.4	0.02	9.4
203.7398616	8/17/2016	2.046	2.05555	0.14	11.8	0.14	11.8
248.2244208	8/18/2016	2.033	2.05555	0.24	14.4	0.24	14.4
173.1118788	8/23/2016	2.031	2.05555	0.02	10.2	0.02	10.2
213.3894084	8/24/2016	2.042	2.05555	0.03	12.5	0.03	12.5
254.990496	8/25/2016	1.97	2.05555	0.02	15.5	0.02	15.5
205.043904	8/30/2016	2.08	2.05555	0.02	11.8	0.02	11.8
275.0138352	8/31/2016	2.028	2.05555	0.16	16.1	0.16	16.1
166.988484	9/6/2016	2.21	2.2469	0.02	9.04	0.02	9.04
274.7339448	10/4/2016	2.401	2.80587	0.02	13.7	0.02	13.7
418.8628224	11/1/2016	3.608	3.4292	0.02	13.9	0.02	13.9
414.3465456	11/3/2016	3.082	3.4292	0.02	16.1	0.02	16.1
337.0239036	11/7/2016	2.967	3.4292	0.02	13.6	0.02	13.6
354.8139576	11/8/2016	2.777	3.4292	0.02	15.3	0.02	15.3
323.9502864	11/9/2016	2.873	3.4292	0.02	13.5	0.02	13.5
456.4727196	11/15/2016	4.337	3.4292	0.02	12.6	0.02	12.6
537.709824	11/16/2016	3.68	3.4292	0.02	17.5	0.02	17.5
576.9968952	11/17/2016	3.242	3.4292	0.04	21.3	0.04	21.3
401.1551676	11/20/2016	3.366	3.4292	0.09	14.2	0.09	14.2
369.1162236	11/21/2016	3.019	3.4292	0.06	14.6	0.06	14.6
391.6544064	11/22/2016	3.232	3.4292	0.03	14.5	0.03	14.5
433.6626528	11/29/2016	3.846	3.4292	0.02	13.5	0.02	13.5
516.540402	11/30/2016	3.915	3.4292	0.02	15.8	0.02	15.8
337.9131144	12/6/2016	3.343	3.18406	0.02	12.1	0.02	12.1
417.5747928	1/10/2017	2.742	2.83858	0.66	17.6	0.66	17.6
338.3998368	2/7/2017	2.936	3.23468	0.02	13.8	0.02	13.8
473.7123336	3/1/2017	3.092	3.55358	0.47	17.9	0.47	17.9
340.1003628	3/2/2017	3.014	3.55358	0.03	13.5	0.03	13.5
480.4100208	3/7/2017	3.702	3.55358	0.46	15.1	0.46	15.1
530.6626908	3/8/2017	3.498	3.55358	0.39	17.8	0.39	17.8
588.8735556	3/9/2017	3.586	3.55358	0.19	19.5	0.19	19.5
348.35346	3/14/2017	3.825	3.55358	0.02	10.9	0.02	10.9
414.1465524	3/15/2017	4.379	3.55358	0.04	11.3	0.04	11.3

387.139464	3/16/2017	3.83	3.55358	0.02	12.1	0.02	12.1
440.508375	3/21/2017	3.375	3.55358	0.15	15.5	0.15	15.5
469.8085464	3/22/2017	3.188	3.55358	0.77	16.9	0.77	16.9
523.2518502	3/23/2017	3.077	3.55358	0.49	19.9	0.49	19.9
286.2184584	3/28/2017	3.358	3.55358	0.02	10.2	0.02	10.2
529.6879116	3/29/2017	4.002	3.55358	0.17	15.7	0.17	15.7
1.299789	4/4/2017	3.117	3.26913	0.04	0.01	0.04	0.01
375.9531888	5/2/2017	2.828	2.92835	0.04	15.9	0.04	15.9
296.5849116	6/6/2017	2.473	2.41167	0.08	14.3	0.08	14.3
268.4092224	7/11/2017	2.453	2.21252	0.02	13.1	0.02	13.1
488.150208	8/8/2017	2.08	2.08839	1.84	26.3	1.84	26.3
317.52882	9/12/2017	2.058	2.09257	0.1	18.4	0.1	18.4
303.697764	10/3/2017	2.055	2.291	0.02	17.7	0.02	17.7
317.7633408	11/7/2017	2.368	2.999	1.19	14.9	1.19	14.9
380.37489	12/5/2017	2.905	3.134	0.1	15.6	0.1	15.6
405.161787	1/9/2018	4.357	3.624	0.75	10.4	0.75	10.4
228.4586208	2/6/2018	4.476	3.74	0.02	6.1	0.02	6.1
358.1107596	3/6/2018	2.838	3.08394	1.43	13.7	1.43	13.7
343.471224	4/3/2018	2.98	3.5245	0.12	13.7	0.12	13.7
515.054214	5/8/2018	2.67	2.55	0.13	23	0.13	23
212.47401	6/3/2018	2.51	2.47	0.05	10.1	0.05	10.1
226.1617848	7/1/2018	2.532	2.2261	0.41	10.3	0.41	10.3
204.3296497	8/1/2018	2.177	2.15	0.454	10.8	0.454	10.8
257.962872	8/2/2018	2.12	2.15	1.69	12.9	1.69	12.9
230.2112551	8/7/2018	2.156	2.15	0.303	12.5	0.303	12.5
331.1407008	8/8/2018	2.121	2.15	4.22	14.5	4.22	14.5
288.8735808	8/9/2018	2.209	2.15	1.48	14.2	1.48	14.2
140.764655	8/14/2018	2.017	2.15	0.268	8.1	0.268	8.1
281.33322	8/15/2018	2.212	2.15	4.15	11.1	4.15	11.1
280.641834	8/21/2018	2.178	2.15	3.05	12.4	3.05	12.4
225.3171096	8/22/2018	2.134	2.15	1.46	11.2	1.46	11.2
238.2084144	8/23/2018	2.046	2.15	1.96	12	1.96	12
201.9661104	8/28/2018	2.168	2.15	1.07	10.1	1.07	10.1
192.460929	8/29/2018	2.05	2.15	0.857	10.4	0.857	10.4
285.556596	8/30/2018	2.026	2.15	5.6	11.3	5.6	11.3
171.216864	9/4/2018	2.184	2.37	0.37	9.03	0.37	9.03
284.6178456	10/2/2018	2.564	2.46	4.66	8.65	4.66	8.65
238.735836	11/6/2018	3.078	2.954	0.36	8.94	0.36	8.94
261.201294	12/2/2018	3.026	2.94	1.53	8.82	1.53	8.82
351.537255	1/8/2019	3.225	2.88	1.27	11.8	1.27	11.8
215.8685568	2/5/2019	2.652	2.93	1.52	8.24	1.52	8.24
347.3586648	3/5/2019	2.506	2.68	4.52	12.1	4.52	12.1
321.0836616	4/9/2019	2.553	2.76	0.28	14.8	0.28	14.8
460.591929	5/7/2019	2.471	2.47	1.65	20.7	1.65	20.7
483.913488	6/4/2019	2.32	2.35	1.01	24	1.01	24
193.9255164	7/9/2019	2.157	2.17	0.98	9.8	0.98	9.8
207.797355	8/6/2019	2.085	2.12	1.25	10.7	1.25	10.7

204.106488	9/10/2019	2.36	2.441	1.11	9.26	1.11	9.26
374.4908532	10/1/2019	2.391	2.58	1.08	17.7	1.08	17.7
303.422544	11/5/2019	2.232	2.52	0.3	16	0.3	16
242.6563866	12/3/2019	2.311	2.94	0.09	12.5	0.09	12.5
472.0600962	1/7/2020	3.531	3.42	0.13	15.9	0.13	15.9
797.7063216	2/5/2020	6.911	3.64	0.04	13.8	0.04	13.8
319.89738	3/3/2020	3.17	2.83	0.1	12	0.1	12
53.5046862	4/14/2020	2.477	2.6	2.22	0.37	2.22	0.37
283.265181	5/5/2020	2.715	2.72	0.31	12.2	0.31	12.2
606.3091596	6/9/2020	3.306	3.035	12.9	9.09	12.9	9.09
363.0695568	7/7/2020	2.579	2.45	0.08	16.8	0.08	16.8
286.7357052	8/11/2020	2.289	2.295	0.02	15	0.02	15
243.2009052	9/15/2020	2.346	2.37	0.13	12.3	0.13	12.3
185.122146	10/6/2020	2.374	2.68	0.29	9.06	0.29	9.06
330.608025	11/3/2020	2.883	3.05	0.15	13.6	0.15	13.6
313.537	12/8/2020	2.883	3.05	0.14	12.9	0.14	12.9

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

TO:	MARIAH LOW, GENERAL MANAGER JOHNATHAN DIX, ASSISTANT GENERAL MANAGER JAMES HEITZMAN, WWTP SUPERVISOR JEFF BAISCH, SENIOR WWTP OPERATOR
FROM:	JAY SWIFT, P.E. KOTA NISHIGUCHI, E.I.T.
DATE:	SEPTEMBER 30, 2021
SUBJECT:	NUTRIENT GENERAL PERMIT COMPLIANCE ROAD MAP LAKE STEVENS SEWER DISTRICT, SNOHOMISH COUNTY, WASHINGTON G&O #20408.07

This memorandum presents a roadmap for the Lake Stevens Sewer District (District) for activities necessary to comply with the new Puget Sound Nutrient General Permit. An updated draft of the permit (Draft Permit) was issued in June 2021, replacing a previous draft issued in March 2021 (March 2021 Draft Permit). Since a final permit has not been issued, this road map will likely need to be updated when the final permit comes out. Ecology plans to issue the final permit in the fall of 2021, probably in November based on discussions between the District and the Ecology Water Quality Program.

The memorandum includes the following sections:

- General Summary of the Draft Permit Requirements
- Timeline for Draft Permit Requirements
- New Testing Requirements
- Costs and Timelines Associated with Engineering Report(s) Required by the Draft Permit
- Discussion of Alternatives and Costs for Anticipated Capital Improvements Required for Compliance with the Draft Permit

1130 Rainier Avenue South, Suite 300 Seattle, Washington 98144 (206) 284-0860 Fax (206) 283-3206

GENERAL SUMMARY OF THE DRAFT PERMIT REQUIREMENTS

The Draft Permit was established to limit existing dissolved oxygen (DO) impairments from excess nutrients discharged from municipal wastewater treatment plants (WWTPs or dischargers). The nutrients targeted with the Draft Permit are nitrate, nitrite, and ammonia, which summed together (and expressed as nitrogen), are called Total Inorganic Nitrogen (TIN). The Draft Permit designates dischargers as either "dominant" or "small" based on the magnitude of the total inorganic nitrogen loading to Puget Sound. The Lake Stevens Sunnyside WWTP is classified as a dominant loader, so this memorandum focuses on requirements for dominant loaders.

The Draft Permit includes the following major requirements for dominant loaders:

- Action Level
- Monitoring Requirements
- Documentation Requirements
- Nitrogen Optimization Plan
- Action Level Exceedance Corrective Action
- Nutrient Reduction Evaluation

Action Level

Dominant loaders have a facility-specific action level that is supposed to represent the current discharge condition and drive corrective actions when the level is exceeded for 2 consecutive years or three times during the permit term. If the dominant loader triggers the corrective action in a single year, they must reduce their effluent load by 10 percent. The March 2021 Draft Permit and Fact Sheet indicated that the calculated action level (AL) is meant to represent predicted 99th percentile plant effluent TIN loads based on historical observations. Calculation of AL assumes that if a facility behaves over the course of the permit cycle in a manner similar to its historical record, it can be assumed that as noted in the fact sheet, "there is only a 1% chance of exceedance for a given year."

There are flaws in Ecology's approach to statistical analysis for the District's action level (118,000 lb/yr) reported in the Draft Permit. Based on a review of the data and calculations, data-input assumptions appear to have misrepresented the distribution of historical loadings, which resulted in a lower proposed action level than appropriate. Gray & Osborne and the District have taken issue with the statistical approach in two letters written in response to both the March 2021 and June 2021 Draft Permits. These letters are attached to this memorandum in Attachment A. Calculations of annual effluent TIN load were separately determined using the more complete WWTP process data and show that annual loading has surpassed the proposed action levels for 3 of the

past 4 years. This would appear to conflict with the intent of the action level determination (1 percent chance of exceedance) as described in the Draft Permit.

Two alternative approaches to data input, which rely on actual measurements and minimize assumptions in the data input, were presented in both letters. The latest letter, submitted with the District's official comments on the Draft Permit in August 2021, advocated a District AL of 141,000 lb/yr. (Based on feedback from Ecology, it is understood that Ecology may raise the District's action level to 123,000 lb/yr.) Ecology is obligated to respond to timely comments on draft permits and consider revisions to the permits. If Ecology does not accept the District's comments, the District would have the opportunity to appeal to the Pollution Control Hearings Board.

Monitoring Requirements

Implementation of the nutrients permit will mean increased monitoring requirements (as identified in Draft Permit Section S6.A) for the District. The requirements are summarized in District Staff Tasks Level of Effort and Requirements below.

Documentation Requirements

The District is obligated to have ready access to the following information at the WWTP site:

- S9.B.3 Original Sampling Records (field notes, as applicable and laboratory reports)
- S9.G.1.a Permit Coverage Letter
- S9.G.1.b Puget Sound Nutrient General Permit
- S9.G.1.c Discharge Monitoring Reports
- S9.G.1.d Attachment to the Annual or Single NOP Reports (as applicable)
- S9.G.1.e Nutrient Reduction Evaluation or AKART Analysis (as applicable)

Per Section S9.E of the Draft Permit, the District must retain records of all monitoring information (field notes, sampling results, etc.), optimization documents submitted with the annual or one-time report, and any other documentation of compliance with permit requirements ***for a minimum of 5 years following the termination of permit coverage.***

Nitrogen Optimization Plan

Per Section S4.C of the Draft Permit, the District is obligated to complete several tasks to "optimize treatment performance to stay below the action level" and "begin the actions described in Section S4 ***immediately upon permit coverage.***"

The Nitrogen Optimization Plan includes the following requirements:

- Treatment Process Performance Assessment
- Annual Nitrogen Optimization Implementation Reports
- Influent Nitrogen Reduction Measures/Source Control

<u>Treatment Process Performance Assessment</u>

- Treatment Process Performance Assessment:
    - Process Modeling (or equivalent):
        - Evaluate current (pre-optimization) process performance to determine the existing empirical TIN removal rate for the WWTP.
        - Develop an initial assessment approach to evaluate possible optimization strategies at the WWTP prior to and after implementation.
    - Identify and evaluate optimization strategies, with a focus on strategies that can be implemented in 1 year (includes an assessment of reasonableness for cost and time frame).
    - Initial selection required by May 1, 2022. (The expected percent TIN removal needs to be documented before implementation.)

<u>Annual Nitrogen Optimization Implementation Reports</u>

The District must submit an Optimization Implementation Report annually starting March 31, 2023. The report is required to include:

- **Strategy Implementation:** This task includes an assessment of costs, challenges, and impacts to the overall treatment process for the optimization approach implemented.

- **Load Evaluation:** This task includes quantification of influent and effluent nitrogen loads, and comparison of percent removal from that predicted by process modeling (or equivalent evaluation).

- **Strategy Assessment:** This task includes an assessment of the success of the optimization strategy and implementation of adaptive management. If changes in the strategy are warranted, an update to the process model (or equivalent) is required, along with updates to performance metrics.

Influent Nitrogen Reduction Measures/Source Control

Per the Draft Permit, the District "must develop an ongoing program to reduce influent TIN loads from septage handling practices, commercial, dense residential, and industrial sources and submit documentation with the Annual Report," and must:

- "Review non-residential sources of nitrogen and identify any possible pretreatment opportunities."

- "Identify strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings."

The impacts of these requirements are not entirely clear. It would not make sense for the District, given its limited industrial base, to conduct a significant commercial sampling program for nitrogen unless there was reason to suspect unusually high nitrogen discharges – for instance, if the ratio of TKN to BOD were higher than expected. It is recommended that the District conduct more TKN monitoring to verify ratios are in the typical range. Some limited sampling of dischargers or at manholes may be in order, for instance, if septage dumping is suspected.

It is also unclear what is meant by the requirement to "identify strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings," as pretreatment measures would not typically be employed for such customers. Based on information from Ecology, this may be additional smaller-scale wastewater treatment facilities required for dense/commercial developments. Also, eliminating septage receiving by some facilities that are covered by the permit.

Action Level Exceedance Corrective Action

After an action level is exceeded, with the next Annual Report the Permittee must submit for review a proposed approach to reduce the most recent calculated annual effluent

nitrogen load by ***at least 10 percent.*** This must be an abbreviated engineering report or technical memo, unless Ecology has previously approved a design document with the proposed solution. The proposed approach must utilize solutions that can be implemented ***within 5 years*** (in addition to selecting a strategy to implement in the next year as required by S4.D.1.b).

If the District exceeds an action level 2 years in a row, or for a third year during the permit term, the Permittee must begin to reduce nitrogen loads by implementing the proposed approach. The District must submit an update to the District's Operation and Maintenance Manual no later than 30 days following implementation.

Nutrient Reduction Evaluation

A Nitrogen Reduction Evaluation (NRE) must be submitted to Ecology by December 31, 2025. The NRE must include:

- An AKART (***A***ll ***K***nown ***A***nd ***R***easonable means of prevention control and ***T***reatment) Analysis:

  The AKART Analysis must "present an alternative representing the greatest TIN reduction that is reasonably feasible."

  The AKART Analysis must include assessments of:

  - Other site-specific main stream treatment plant upgrades.
  - Side stream treatment opportunities.
  - Alternative effluent management options (e.g., disposal to ground, reclaimed water beneficial uses).
  - The viability of satellite treatment.
  - Other nutrient reduction opportunities that could achieve a final effluent concentration of ***3 mg/L TIN*** (or equivalent load reduction) on both an annual average and seasonal average basis.

The AKART Analysis must include:

- **Wastewater Characterization:** Including current flow rates and growth trends within the sewer service area and influent and effluent quality.

- **Treatment Technology Analysis:** Identification and screening of potential treatment technologies for meeting two different levels of treatment:

  - AKART for nitrogen removal (annual basis), and
  - 3 mg/L TIN (or equivalent load) as an annual average and seasonal average.

  For the District, achieving effluent TIN of less than 3 mg/L is expected to require extensive capital and operating costs, and may be deemed unaffordable in the economic evaluation (discussed below).

- **Economic Evaluation:** The economic evaluation must include capital, operation and maintenance costs, 20-year net present value, cost per pound of nitrogen removed, and rate structure evaluation. An assessment of affordability to fund potential alternatives for enhanced treatment will be a major part of the economic evaluation.

- **Environmental Justice (EJ) Review:** The EJ Review must evaluate impacts to communities of color, tribes, indigenous communities, and low-income populations, and assess mitigation of impacts.

- Selection of the most reasonable treatment alternative based on the AKART assessment and the selected alternative(s) for achieving an effluent concentration of 3 mg/L TIN.

- **Viable Implementation Timelines:** Viable implementation timelines that include funding, design, and construction for meeting both the AKART and 3 mg/L TIN preferred alternatives.

TIMELINE FOR DRAFT PERMIT REQUIREMENTS

Table 1 summarizes the timeline for activities required by the Draft Permit. As with all the information in this memorandum, this timeline should be reviewed and updated after the issuance of the final permit.

TABLE 1

Timeline for Draft Permit Requirements

Due Date	Permit Condition	Description
Fall 2021 (after permit issuance)	S4.C.1	Begin nitrogen optimization planning
Late 2021 (90 days after permit issuance)	S2.A.1	Notice of Intent (application) due
May 1, 2022	S4.C.1	Treatment Process Performance Assessment and Initial Selection of Optimization Strategy
March 31, 2023 (annual)	S4.C.2	Optimization Implementation Report
March 31, 2024 (annual)	S4.C.2	Optimization Implementation Report
March 31, 2025 (annual)	S4.C.2	Optimization Implementation Report
December 31, 2025	S4.E	Nutrient Reduction Evaluation

NEW REQUIREMENTS FOR DISTRICT STAFF

New Testing Requirements

The Draft Permit will add some monitoring requirements for the District. Table 2 summarizes the District's existing versus new/modified testing requirements mandated by the Draft Permit for both influent and effluent. (Only new or modified requirements are shown.)

TABLE 2

New or Modified Testing Requirements

Test	Current Frequency Required by District NPDES Permit	Future Minimum Required Frequency After Nutrients General Permit Issuance	Current Frequency Required by District NPDES Permit	Future Minimum Required Frequency After Nutrients General Permit Issuance
	Influent		**Effluent**	
Total Ammonia	None	**2/week**	1/month November–June 3/week July–October	**2/week November–June** **3/week July–October**
Nitrate + Nitrite Nitrogen	None	**1/month**	1/month	**2/week**
Total Kjeldahl Nitrogen (TKN)	None	**1/month**	1/month	1/month
Total Organic Carbon (TOC)	None	None	None	**1/month**

(1) TIN, calculated from Ammonia plus Nitrate + Nitrite Nitrogen, must be reported twice a week.

Other influent and effluent testing is mandated by the Draft Permit but incorporation of those requirements does not alter the District's existing monitoring frequency.

Some of these tests are already performed by the District or the third-party laboratories it uses. District staff routinely analyze effluent ammonia and nitrate concentrations in house and record this data on their plant process data sheets, but do not submit this nitrate data on their monthly DMRs. Effluent nitrate/nitrite concentrations are also analyzed once a month at the Everett WWTP laboratory and these data are reported on the District's DMRs.

The District's laboratory accreditation scope is limited to: turbidity, TSS, pH, ammonia, nitrite, orthophosphate, total phosphorus, BOD, CBOD, and fecal coliform. The District will either have to obtain accreditation for the other parameters or utilize third-party laboratories. Laboratory accreditation costs a minimum of $200 per test plus additional costs for all testing materials and laboratory supplies to validate testing parameters, write standard operating procedures (SOPs), and ongoing proficiency testing of laboratory analyst(s).

Assuming all the additional analyses are performed by third-party laboratories, the minimum additional annual analytical costs to comply with the permit are ***$9,200*** based on list prices provided by the District for their third-party laboratories. In the first year, given the lack of influent TKN data, it is recommended that the District conduct additional weekly TKN testing in WWTP influent beyond what is specified in the General Permit. This will add an ***additional $2,000*** to the first year's analytical costs.

Other Requirements for District Staff

In addition to increased costs for analytical testing, compliance with the new Draft Permit will require more labor from the District to meet documentation and reporting requirements. The District will need to support efforts by consultants with developing the Nitrogen Optimization Plan and Nutrient Reduction Evaluation. Finally, Action Level Exceedance Corrective Actions will require some effort by the District. The estimated additional annual costs for these activities are $5,000 to $20,000.

ENGINEERING REPORTS – COST AND TIMELINE

There are several engineering reports potentially necessary for compliance with the Draft Permit. These are described in more detail in the General Summary of the Draft Permit Requirements section.

- Treatment Process Performance Assessment and Initial Selection of Optimization Strategy:
    - Start in autumn 2021 (due May 1, 2022).
    - Estimated cost range is $20,000 to $30,000.
    - Much of the groundwork for this assessment will be completed as part of the Facility Plan. The estimated cost includes some money for contingency and revisions.
- Annual Nitrogen Optimization Implementation Reports:
    - Start January 1 each year from 2023 to 2025 (due annually in 2023 to 2025 on March 31).
    - Estimated average annual cost is $0 to $10,000.
    - The annual reports could potentially be completed by District staff, with reference to process modeling completed by consultants. However, if treatment modifications are warranted, the effort to complete the annual report will be significantly increased.
- Nutrient Reduction Evaluation:
    - Start January 1, 2025 (due December 31, 2025).
    - Estimated cost is $150,000 to $200,000.
    - Completion of the NRE is a significant effort for the District. The requirement to evaluate alternatives to meet 3 mg/L TIN, in particular, will be costly since it is expected to involve extensive process model calibration, additional treatment tankage, revisions to plant hydraulics, and consideration of small-footprint technologies. In addition, life cycle costs must be evaluated and detailed assessment of rate impacts on various groups must be completed.

DISCUSSION OF ALTERNATIVES AND ANTICIPATED CAPITAL IMPROVEMENTS

The Draft Permit limit for effluent TIN will require improvements that must be made prior to 2026 (5 years after permit issuance) and will also require assessment of long-term solutions for TIN reduction. Historical treatment plant performance indicates that the WWTP will not meet the annual effluent TIN load limit of 118,000 pounds per year in the Draft Permit. In fact, the WWTP effluent TIN loads have exceeded this proposed limit for 3 of the past 4 years. These exceedances are directly related to denitrification performance and effluent nitrate concentration. Consequently, the denitrification performance of the plant will need to improve once the Puget Sound Nutrient General Permit is issued in late 2021.

Certain optimization efforts, such as raising the anoxic zone walls or reducing dissolved oxygen concentrations in the third aerobic zone may marginally improve denitrification performance and reduce effluent TIN loads. However, additional improvements to the existing secondary treatment system will still be required to ensure the District reliably meets limits proposed in the Draft Permit. The recommended improvements consist of the installation of a supplemental carbon addition system that will provide the external carbon source necessary for improved denitrification in the existing treatment process. The process of denitrification not only requires biodegradable chemical oxygen demand (bCOD) to support denitrification but also specifically requires readily biodegradable COD (rbCOD) to provide nitrification at an effective rate. This limitation is kinetic and requires influent carbon sources like volatile fatty acids (VFAs), alcohols, or simple sugars, all of which are directly available to the microorganisms desired for the WWTP anoxic zones. With this objective, the carbon addition system will introduce rbCOD to the system to promote better kinetics for denitrification. It will require relatively minor modifications to the existing facilities, but will result in additional long-term operation and maintenance costs. (These modifications will not allow the District to reach the ultimate 3 mg/L TIN limit.)

The supplemental carbon addition system would be comprised of storage and peristaltic metering pumps with small-diameter feed piping. The initial assumption is that the external carbon source would be MicroC-2000 but the carbon addition system would also be capable of utilizing other external carbons sources, such as locally sourced glycerin or acetate. The external carbon source would be injected into the primary clarifier effluent channel upstream of the anoxic zones, ensuring that it is thoroughly mixed into the mixed liquor return stream prior to entering the anoxic zones. The GPS-X model, which was developed and calibrated as part of the Facility Planning effort, was used to develop preliminary sizing of this system and estimate the external carbon required to reliably meet the effluent permit limits at the projected year 2026 flows and loads, approximating

conditions near the end of the proposed permit cycle. If a glycerin-based MicroC-2000 (1,100,000 mg-COD/L) carbon source is used, a minimum storage volume of 3,500 gallons is recommended. This storage would provide a 30-day supply for the maximum month demand to reduce effluent TIN loading to 258 pounds per day, which represents 80 percent of the average daily load for the proposed annual load of 118,000 pounds per year. One of the existing 16,000-gallon sodium hydroxide storage tanks could be repurposed for this use. The approximate cost of installing this system is provided in Table 3.

TABLE 3

Estimated Cost of Carbon Addition System Installation

Item	Unit	Quantity	Unit Cost	Total Cost
Mobilization and General Requirements				
Mobilization and Demobilization	%	8	$13,000	$13,000
Subtotal				$13,000
Process Equipment and Modifications				
Process Piping and Fittings	LS	1	$15,700	$15,700
Metering Pumps	EA	2	$15,000	$30,000
Inline Mixing Unit	LS	1	$3,500	$3,500
Subtotal				$49,200
Electrical				
Instrumentation	LS	1	$35,900	$35,900
Power Distribution, Integration, and Controls	LS	1	$65,000	$65,000
Subtotal				$100,900
Total				
Capital Cost Subtotal				$163,100
Preliminary Estimate Contingency (25%)				$41,000
Washington State Sales Tax (9%)				$18,400
Total Estimated Construction Cost				**$222,500**
Engineering (Design, Permitting, and Construction Management, 25%)				$55,600
Total Project Cost				**$278,100**

The existing storage volume was designed to provide surplus capacity for alkalinity demand. With the alkalinity credit provided by the carbon addition system, the existing alkalinity storage would be in excess of demand. Furthermore, the requisite reliability for the system would be provided by the redundant metering pump and by the ability to use totes for temporary storage of chemical alkalinity as a backup. To deliver external

carbon from this location, a new set of metering pumps could then be installed near the existing sodium hydroxide metering pumps.

As previously mentioned, the carbon addition system affects future operation and maintenance costs. Specifically, the system will result in added costs for the external carbon source and biosolids hauling from additional sludge production. The increased denitrification will result in reduced alkalinity consumption and will reduce the annual cost of alkalinity addition. These cost effects have been estimated using results from the aforementioned GPS-X model and calculated with chemical costs collected for MicroC-2000 as well as sodium hydroxide (added as an alkalinity source). The resultant annual costs were estimated for 2026. For additional context, GPS-X modeling was repeated for 2041 to determine the carbon addition necessary to meet the proposed annual load of 118,000 pounds per year, though it seems likely that more stringent limits will be in place by 2041. Along with the annual costs in 2026, the estimated costs in 2041 are summarized in Table 4.

TABLE 4

Estimated Annual Costs from Carbon Addition System

Item	Unit	Quantity	Unit Cost/ Credit	Total Cost
Year 2026				
MicroC-2000 Consumption	GAL	27,900	$4.20	$117,180
Alkalinity Credit, 25% NaOH	LB	459,300	($0.13)	($59,709)
Additional Hauled Waste	TN (WET)	100	$68	$6,810
Total Annual Costs for Carbon Addition in 2026				**$64,281**
Year 2041				
MicroC-2000 Consumption	GAL	37,900	$6.40	$242,560
Alkalinity Credit, 25% NaOH	LB	585,600	($0.20)	($117,120)
Additional Hauled Biosolids	TN (WET)	110	$103	$11,319
Total Annual Costs for Carbon Addition in 2041				**$136,759**

Finally, the existing gravity thickener provides the opportunity to increase the readily biodegradable carbon from influent BOD through an on-site fermentation process and decrease the cost of external carbon addition. Specifically, static primary sludge can undergo fermentation to yield readily biodegradable carbon in the form of VFAs. This may be achieved by converting the existing gravity thickener into a fermenter and thickener, which would involve increasing the solids retention time (SRT, the average time solids remain in the tank) of the thickener to above 5 days by increasing the sludge blanket height and decreasing the sludge flow out of the thickener. Because fermentation

produces additional odors, the system requires both covering and odor control. The existing gravity thickener is presently covered and is served by an 8-inch odor control duct. Given this, the existing gravity thickener includes most of the infrastructure necessary to accomplish fermentation. It is recommended that this method of yielding VFAs be pilot tested at the plant because of the potential savings in chemical costs. Such a trial would involve additional monitoring of sludge blanket levels as well testing of baseline and trial rbCOD in the overflow of the gravity thickener/fermenter.

STAFF REPORT

Council Agenda Date: October 5, 2021

Subject: Growth Allocations

Contact Person/Department: Russ Wright, Comm. Dev. Director
David Levitan, Planning Manager

Budget Impact: NA

RECOMMENDATION(S)/ACTION REQUESTED OF COUNCIL:

Discuss growth allocations

SUMMARY/BACKGROUND:

City of Lake Stevens staff has been participating in a working group of the Planning Advisory Committee (PAC) through Snohomish County Tomorrow (SCT) to review proposed growth targets for 2044 that are consistent with the Vision 2050 Regional Growth Strategy. The County population is expected to grow to approximately 1,136,309 by 2044, which is an increase of 291,909 people over the next 23 years.

In past meetings, staff has shared with City Council that we are substantially meeting our current population and employment targets for 2035.

- The pre-annexation population target is 39,340. Under current zoning a 1,251-population surplus is anticipated.
- The pre-annexation employment target is 7,412 jobs. Under current zoning there is an estimated 105 job shortfall.

With the recent adoption of the revised Buildable Lands Report, Snohomish County Planning staff are taking the lead on developing a future growth model for the county and its cities. Most of the county's residential and commercial growth will be directed toward High Capacity Transit (HCT) communities and Metropolitan cities (Everett). The remaining growth allocation will be distributed to Core Cities, Cities and Towns and Unincorporated Areas. Lake Stevens is the largest city in the Cities and Towns category.

- Lake Stevens' 2044 employment target is 8,894 (increase of 3,219 jobs, including additional capacity from recent annexations)
- Lake Stevens' 2044 population target is 47,770 (increase of 8,819 residents, including additional capacity from recent annexations)

What this means for the city is that PCD staff will have to re-evaluate current city zoning under remaining buildable lands to identify if there is adequate capacity to accommodate projected growth. Final reconciliations will need to be made for those jurisdictions that cannot meet current or future targets, which could result in transfer within defined reginal geographies. In the case of Lake Stevens and other jurisdictions there also pending docket applications that could add capacity through urban growth area (UGA) expansions. To date, Lake Stevens' requests have not been included for consideration on the future County Docket.

APPLICABLE CITY POLICIES: Comprehensive Plan

BUDGET IMPACT: NA

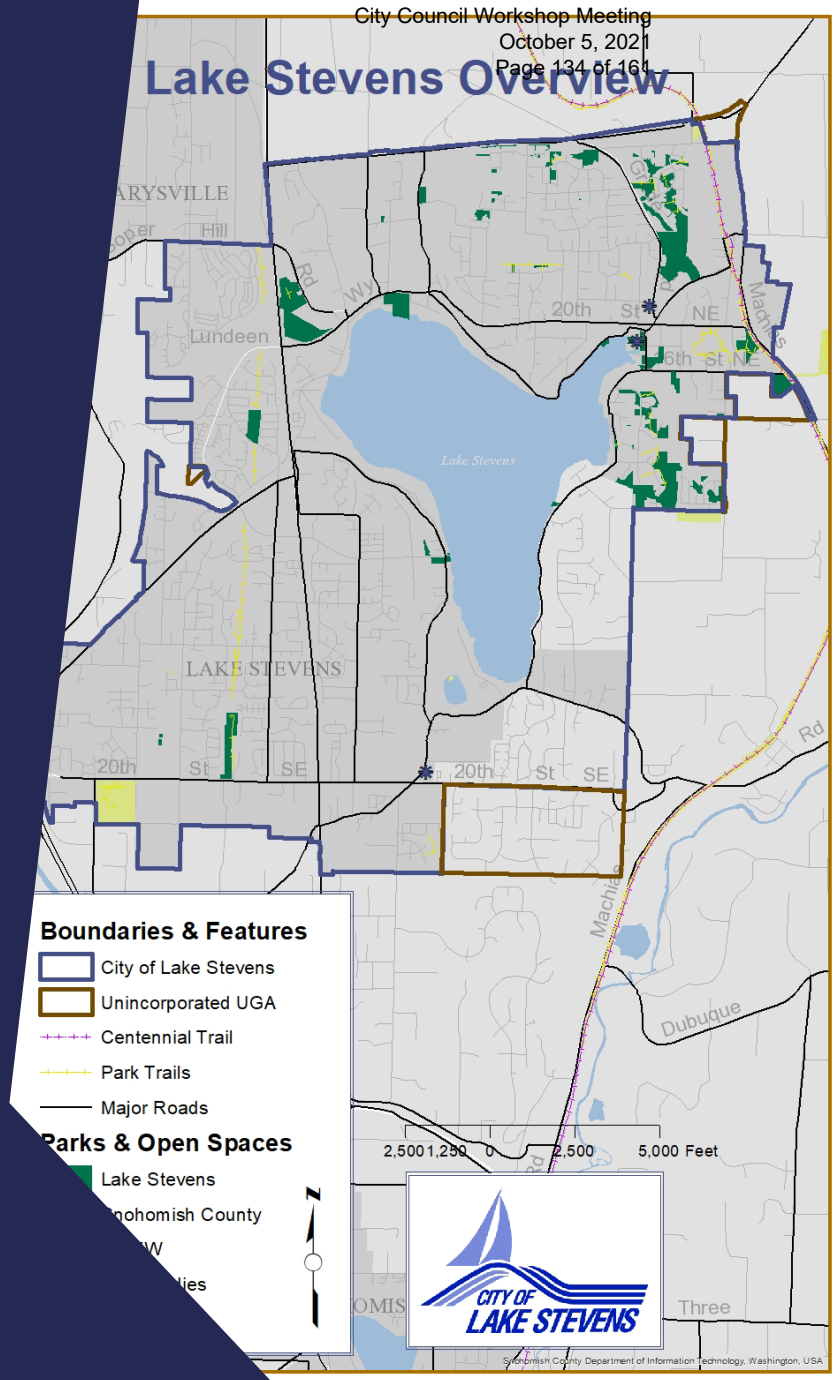
ATTACHMENTS: Draft Growth Slideshow

Growth Update

Russ Wright, Community Development Director

City Statistics

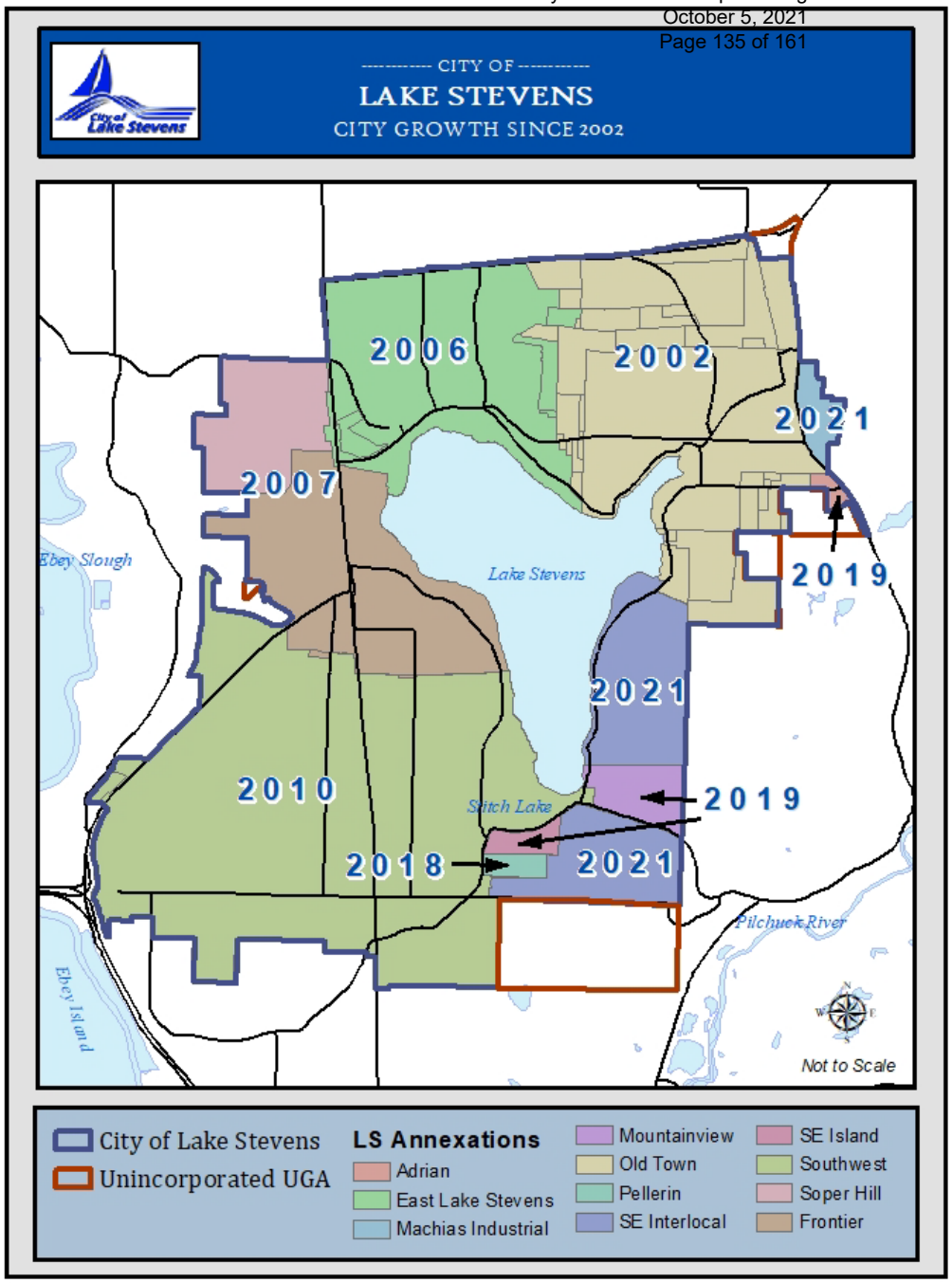
- City 7,493 acres
  - Lake Stevens 1,000 acres
- UGA 314 acres
- 2021 OFM Population estimate 36,960
- **2021 Census population w/ annexation – 38,951**
- City Employees - 98



Changing City

Population 2000	Population 2021*	Growth 2000 - 2021
6,361	36,960	30,599

* Population growth includes annexations and new housing



Growth Strategy & Results

By the numbers

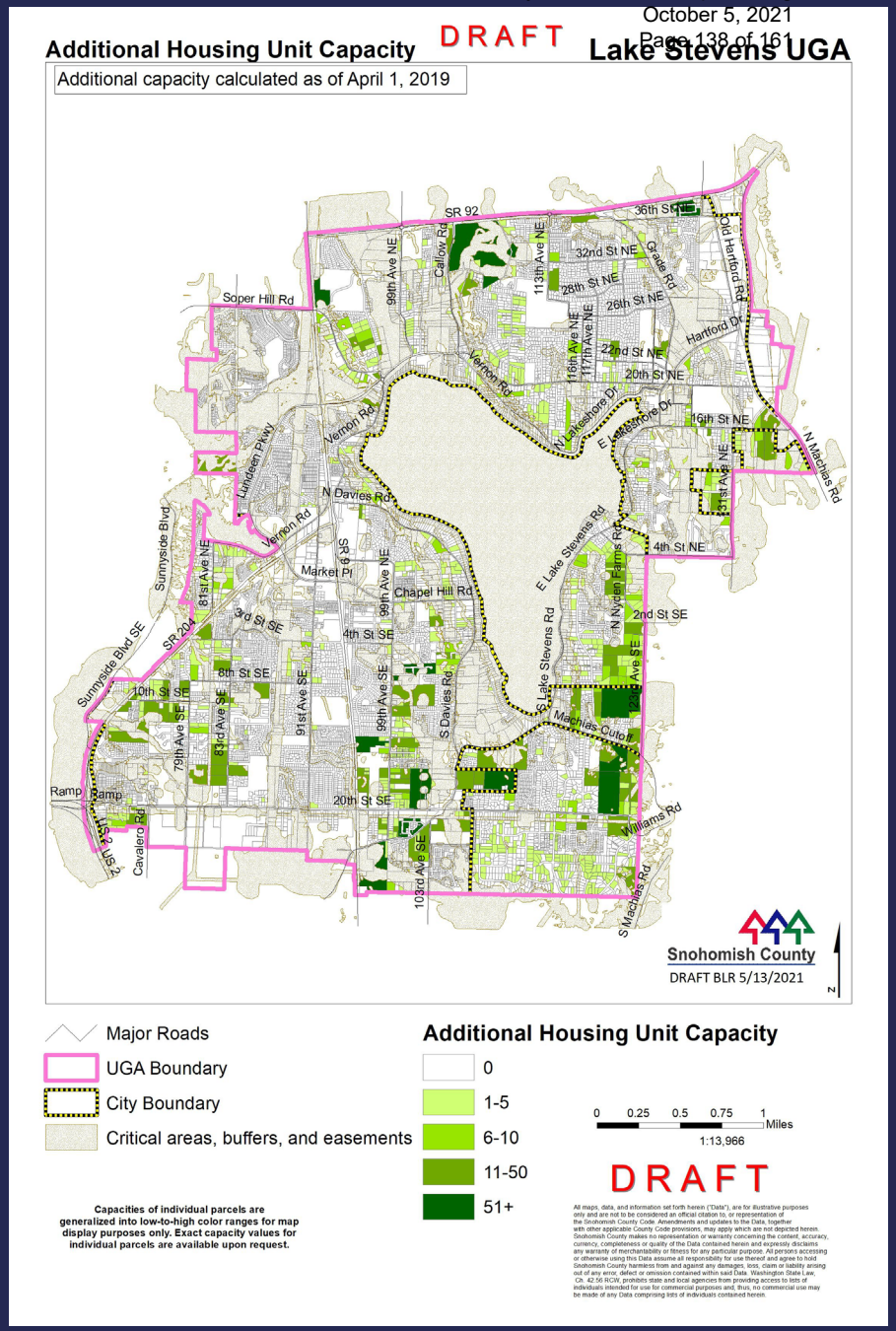
Residential Growth

2012 – 2020

- Built between 2012 – 2018
  - Single-family – 934
- Built between 2019 – 2020
  - Single-family – 478
  - Multifamily / Mixed-Use – 17
- Active housing developments
  - Single-family – 938
  - Multifamily / Mixed-Use – 429
- In the works
  - Single-family – 91
  - Multifamily / Mixed-Use – 150
- **TOTAL RESIDENTIAL – 3,187 new dwellings**
  - Single-family – 2,450
  - Multifamily / Mixed-Use – 737

Buildable Lands - Population

- 11,809 total housing units
- Population Target (pre-annexation)
  - Target 39,340
  - Total residents 2019 – 33,057
  - Pop. surplus - 1,251 residents
- Remaining acres (City/UGA)
  - Pending = 230 (228/2)
  - Vacant = 73.5 (49/24.5)
  - Partially-used = 309 (154/155)•
  - Re-developable = 304

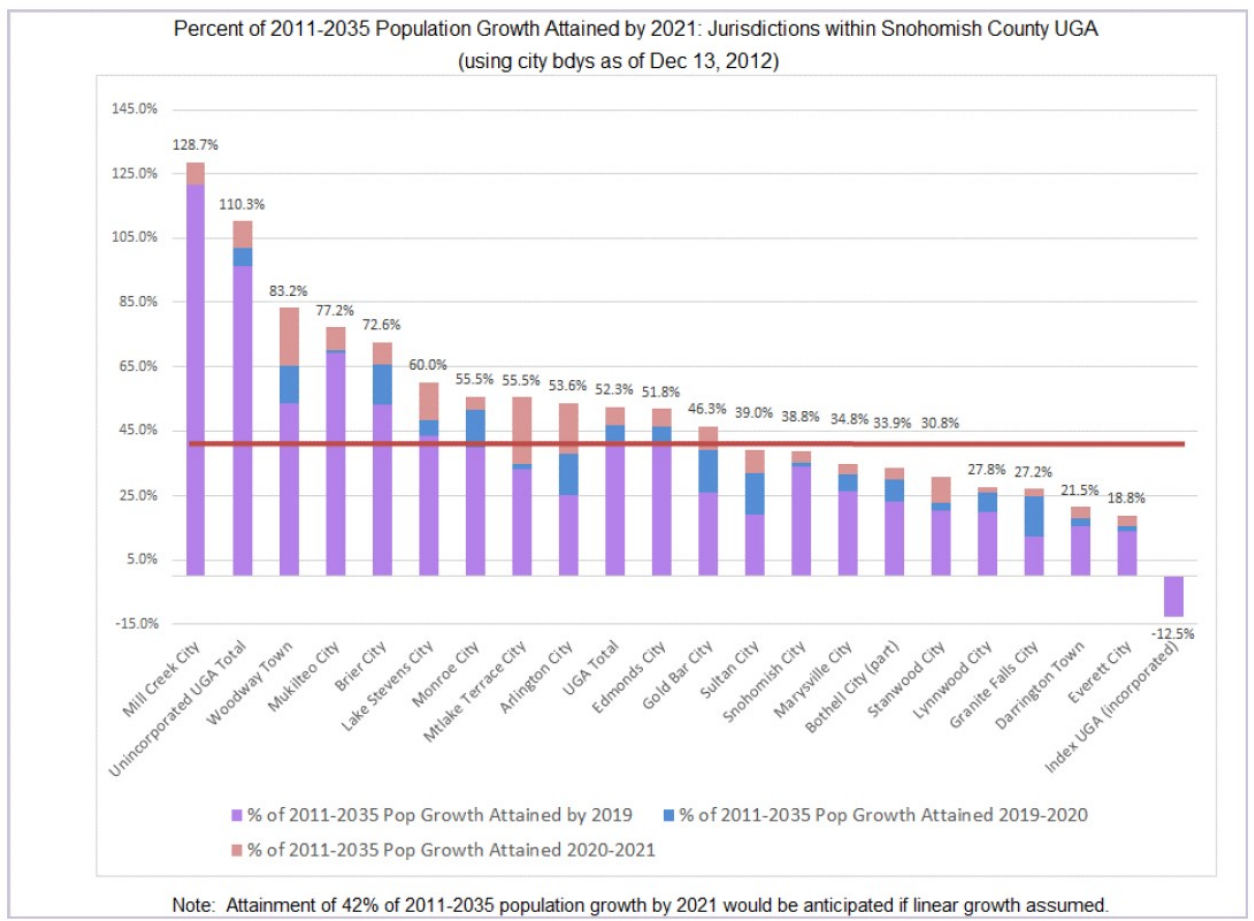


Population Growth

Lake Stevens population target attained – 60% as measured between change 2012-2019

2012-2019 – 6,678 new residents

Lake Stevens target attained based on 2021 population - 90% before the current annexation (35,460 / 39,340)



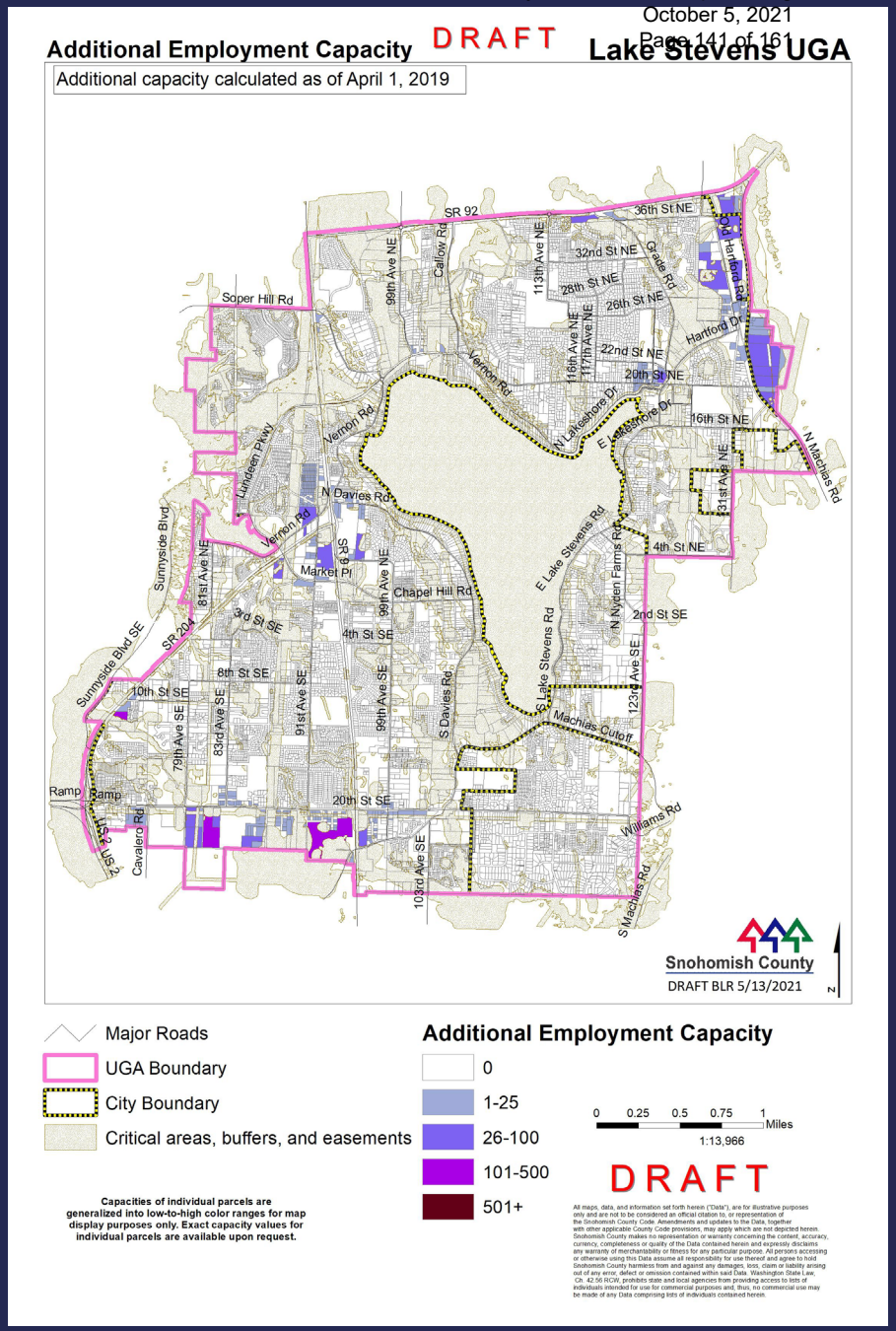
Commercial Growth

2016-2021

- >263,000 feet of new commercial buildings
  - Costco
  - Vernon Village
  - Bartell's
  - The Ram
  - Hartford Industrial
  - Clock Tower storage
  - Perasso Mixed-Use
- Multiple tenant improvements
  - Francisco's
  - Meatheads
  - Target
  - Biscuit and Bean
  - Frontier Heights Renovation (TJ Maxx, Ross Michaels & Ulta Beauty)
  - Marshbank
  - LJ's
  - Starbucks
  - SAARS / Albertsons
  - LS Donuts
- In the works
  - Soper Hill Commercial 52,000 square feet w/ assisted living facility & 7 commercial lots
  - Arco
  - Lee Johnson Auto
  - Two mixed-use buildings downtown

Buildable Lands - Employment

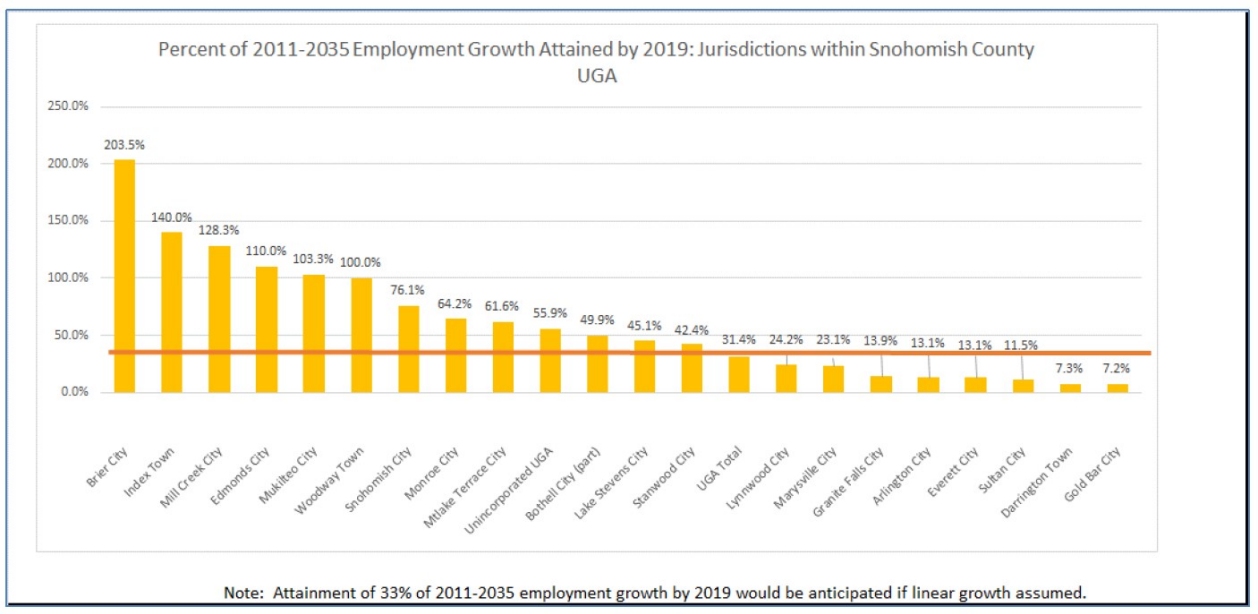
- 5,500 estimated jobs -
  - Target 7,412
  - Remaining Capacity – 1,912
- Projected Shortfall – 105 jobs
- Remaining acres (City/UGA)
  - Pending = 21.0 (21.0/0)
  - Vacant = 41.3 (40.5/0.8)
  - Partially-used = 6.3 (6.3/0)
  - Re-developable = 187.7 (179.3/8.4)



Employment Growth

Lake Stevens employment target attained – 45.1%

New jobs between 2012-2019 – 1,568



VISION 2050 Regional Growth Strategy (RGS)

Courtesy Snohomish County PDS

Regional Population and Job Growth 2017-2050:

	Population Growth	Job Growth
Region	1,756,000	1,158,000

Data Source: PSRC Regional Forecast

Countywide Population and Job Growth 2017-2050:

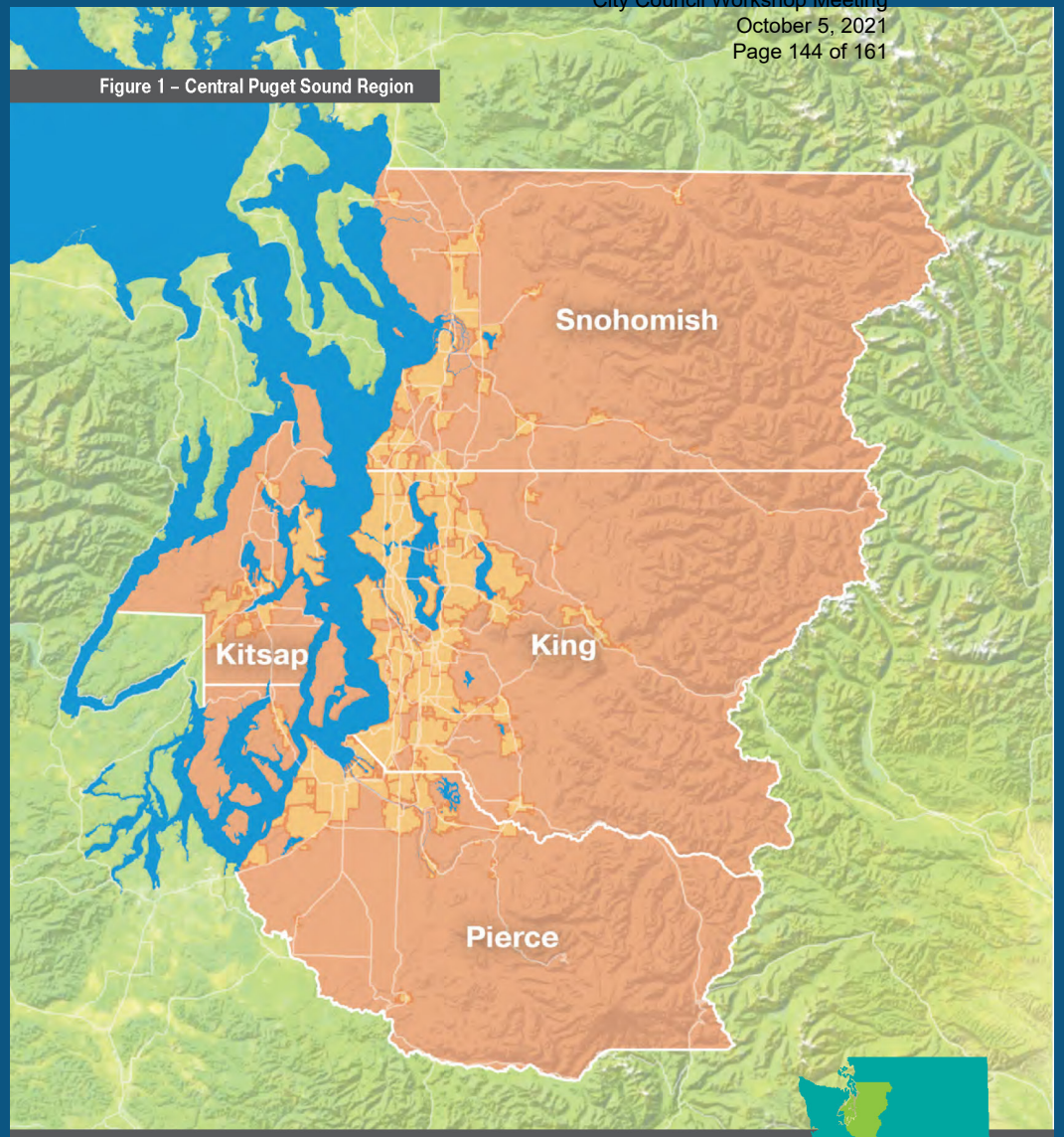
	Population Growth Share	Job Growth Share
King County	50%	59%
Kitsap County	5%	5%
Pierce County	21%	17%
Snohomish County	24%	19%

Data Source: County growth share from VISION 2050 Regional Growth Strategy

Note: Central Puget Sound counties have agreed to use this forecast for initial growth target setting for the 2024 Comprehensive Plan Updates

- Multi-County Planning Policies (MPPs) focus on:
  - Climate change
  - Equity
  - Development around high-capacity transit
  - Affordable housing and displacement

Courtesy Snohomish County PDS



Puget Sound Regional Council

The region's local governments come together at the Puget Sound Regional Council (PSRC) to make decisions about transportation, growth management, and economic development.

PSRC serves King, Pierce, Snohomish, and Kitsap counties, along with cities and towns, tribal governments, ports, and state and local transportation agencies within the region.

Regional Growth Strategy (RGS) 2017-2050

Courtesy Snohomish County PDS

Regional Geographies

RGS distributes population & employment growth to different jurisdiction types throughout the central Puget Sound

Regional plan anticipates 1.8 million people by 2050

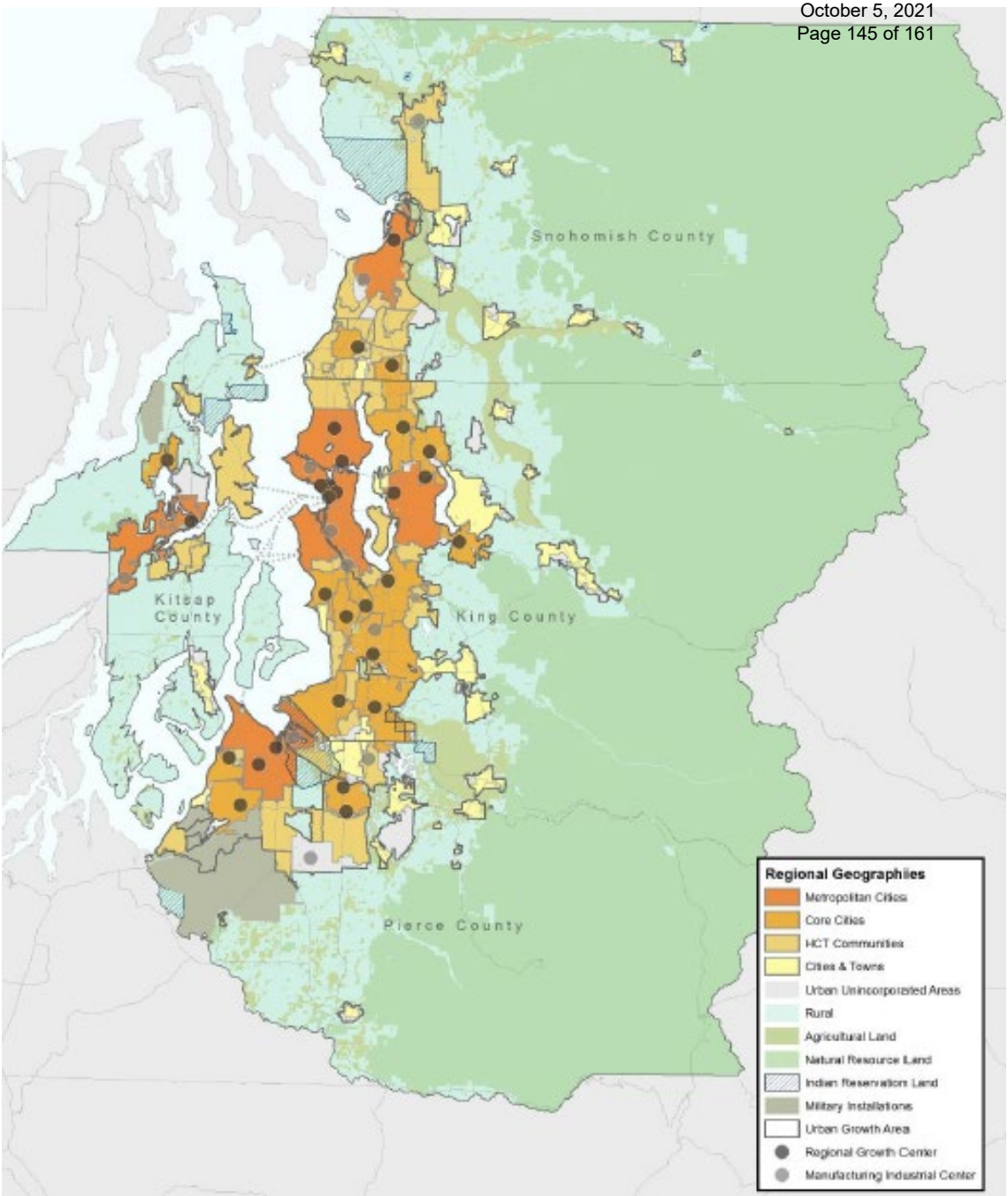
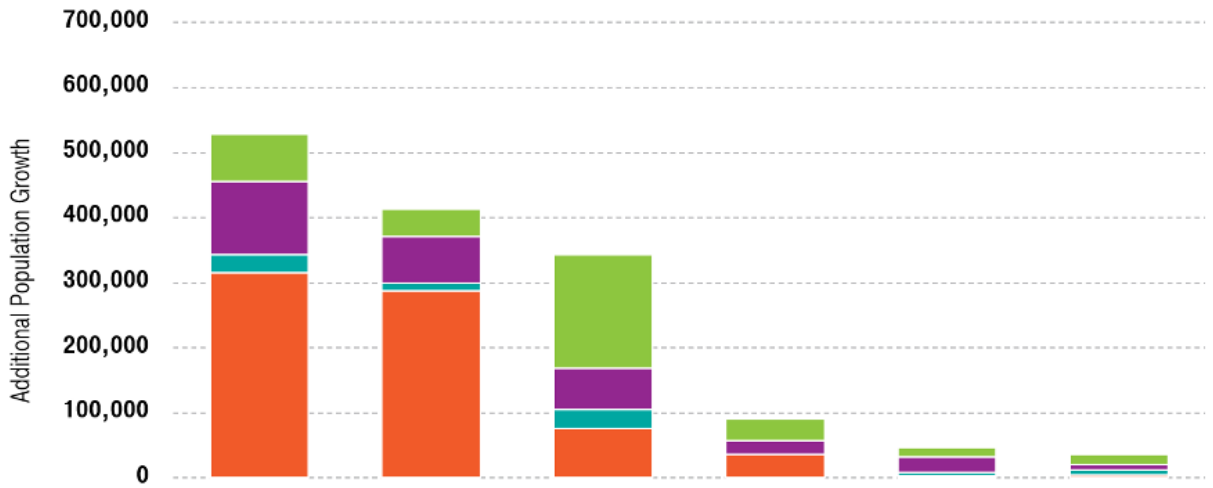
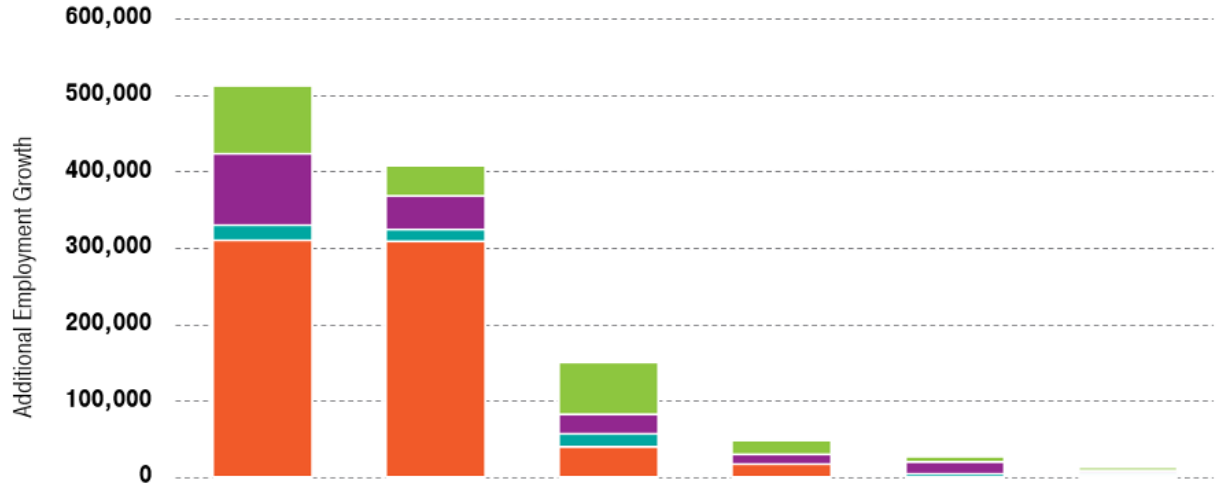


Figure 1 Regional Growth Strategy — Population Growth 2017–2044 (Illustrative)



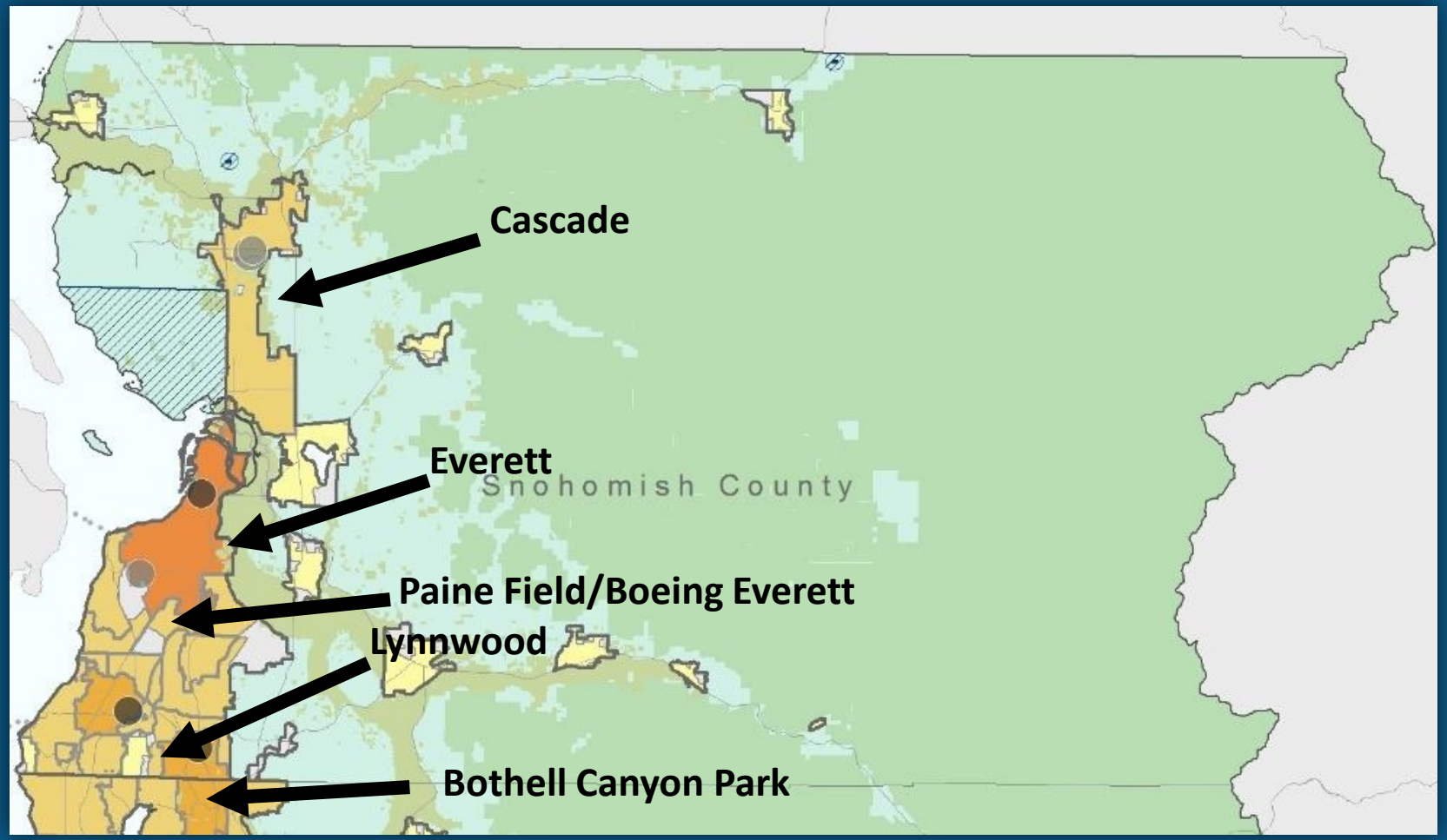
County	Metropolitan Cities		Core Cities		High Capacity Transit Communities		Cities & Towns		Urban Unincorporated		Rural	
King	316,000	44%	288,000	40%	76,000	11%	36,000	5%	3,000	0%	5,000	1%
Kitsap	27,000	34%	12,000	16%	29,000	36%	-	0%	5,000	6%	7,000	8%
Pierce	113,000	38%	71,000	23%	64,000	21%	21,000	7%	24,000	8%	9,000	3%
Snohomish	72,000	20%	42,000	12%	174,000	50%	34,000	9.5%	15,000	4%	15,000	4.5%
Total	**529,000**	**36%**	**412,000**	**28%**	**343,000**	**24%**	**91,000**	**6%**	**47,000**	**3%**	**36,000**	**2%**

Figure 2 Regional Growth Strategy — Employment Growth 2017–2044 (Illustrative)



County	Metropolitan Cities		Core Cities		High Capacity Transit Communities		Cities & Towns		Urban Unincorporated		Rural	
King	250,000	46%	248,000	45%	32,000	6%	14,000	3%	1,000	0%	2,000	0%
Kitsap	16,000	35%	12,000	26%	14,000	32%	-	0%	1,000	2%	2,000	5%
Pierce	76,000	48%	35,000	23%	23,000	15%	10,000	7%	9,000	6%	3,000	2%
Snohomish	71,000	39%	31,000	17%	55,000	30%	14,000	8%	6,000	2%	3,000	2%
Total	**412,000**	**44%**	**327,000**	**35%**	**124,000**	**13%**	**39,000**	**4%**	**17,000**	**2%**	**10,000**	**1%**

Regional Growth Strategy (RGS)



MPP-RGS-8

Attract 65% of the region's residential growth and 75% of the region's employment growth to ***regional growth centers*** *and* ***high-capacity transit station areas*** *to support compact growth.*

Courtesy Snohomish County PDS

Snohomish County

Regional Growth Strategy (RGS)

Courtesy Snohomish County PDS

Regional Geographies in Snohomish County:

Metropolitan City: Everett

Core Cities: Bothell, Lynnwood

High Capacity Transit (HCT) Communities:

- Arlington, Edmonds, Marysville, Mill Creek, Mountlake Terrace, Mukilteo (cities)
- Bothell MUGA, Edmonds MUGA, Everett MUGA, Larch Way Overlap, Lynnwood MUGA, Mill Creek MUGA, Mukilteo MUGA (unincorporated portions of SWUGA)

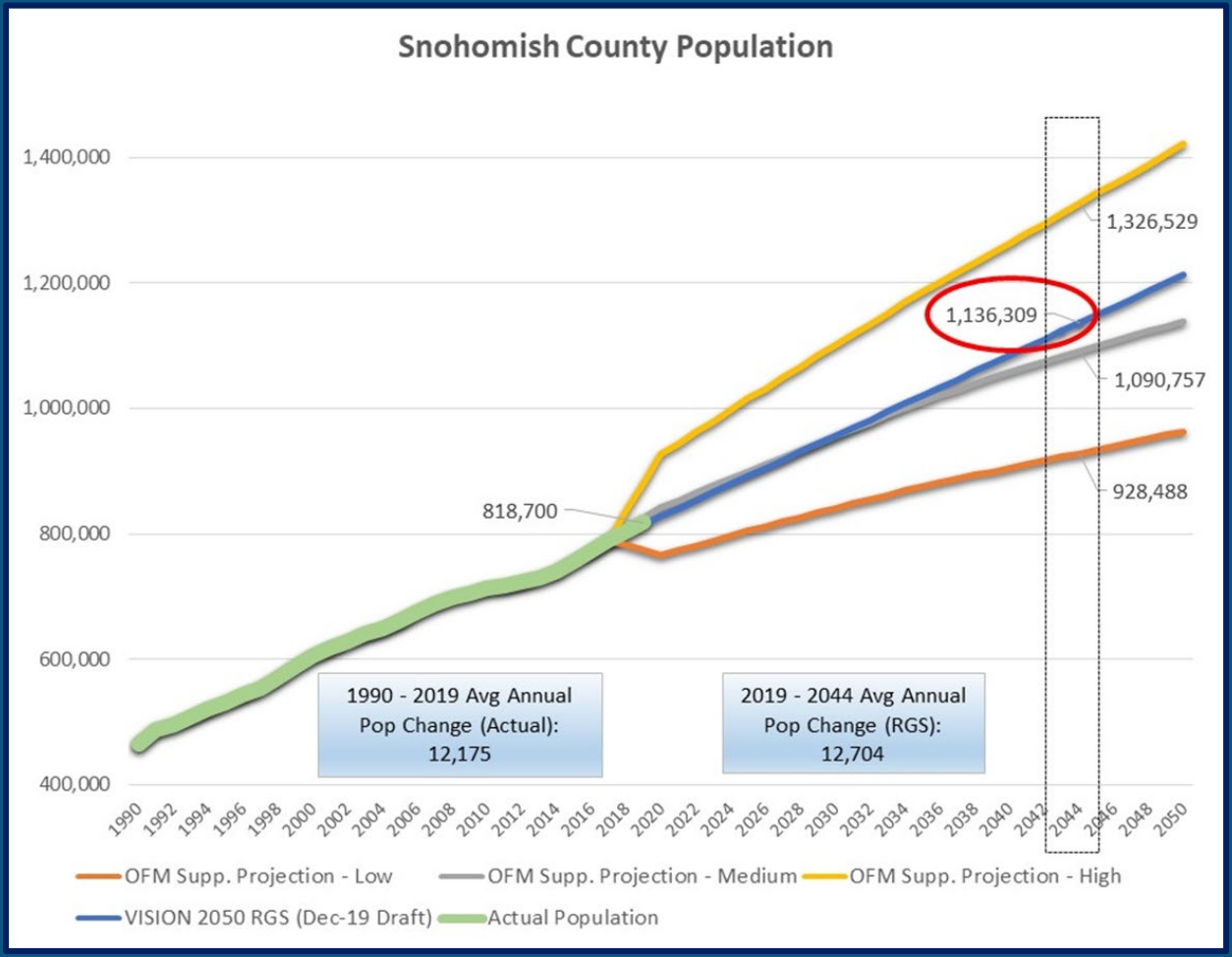
Cities & Towns: Brier, Darrington, Gold Bar, Granite Falls, Index, Lake Stevens, Monroe, Snohomish, Stanwood, Sultan, Woodway

Urban Unincorporated Areas: Remaining Urban Unincorporated areas (Brier, Mountlake Terrace and Woodway unincorporated MUGAs, Paine Field area, Lake Stickney and Silver Firs Gap, Maltby UGA, and all unincorporated non-SW UGAs)

Rural: Rural Designated Lands

2044 Growth Targets

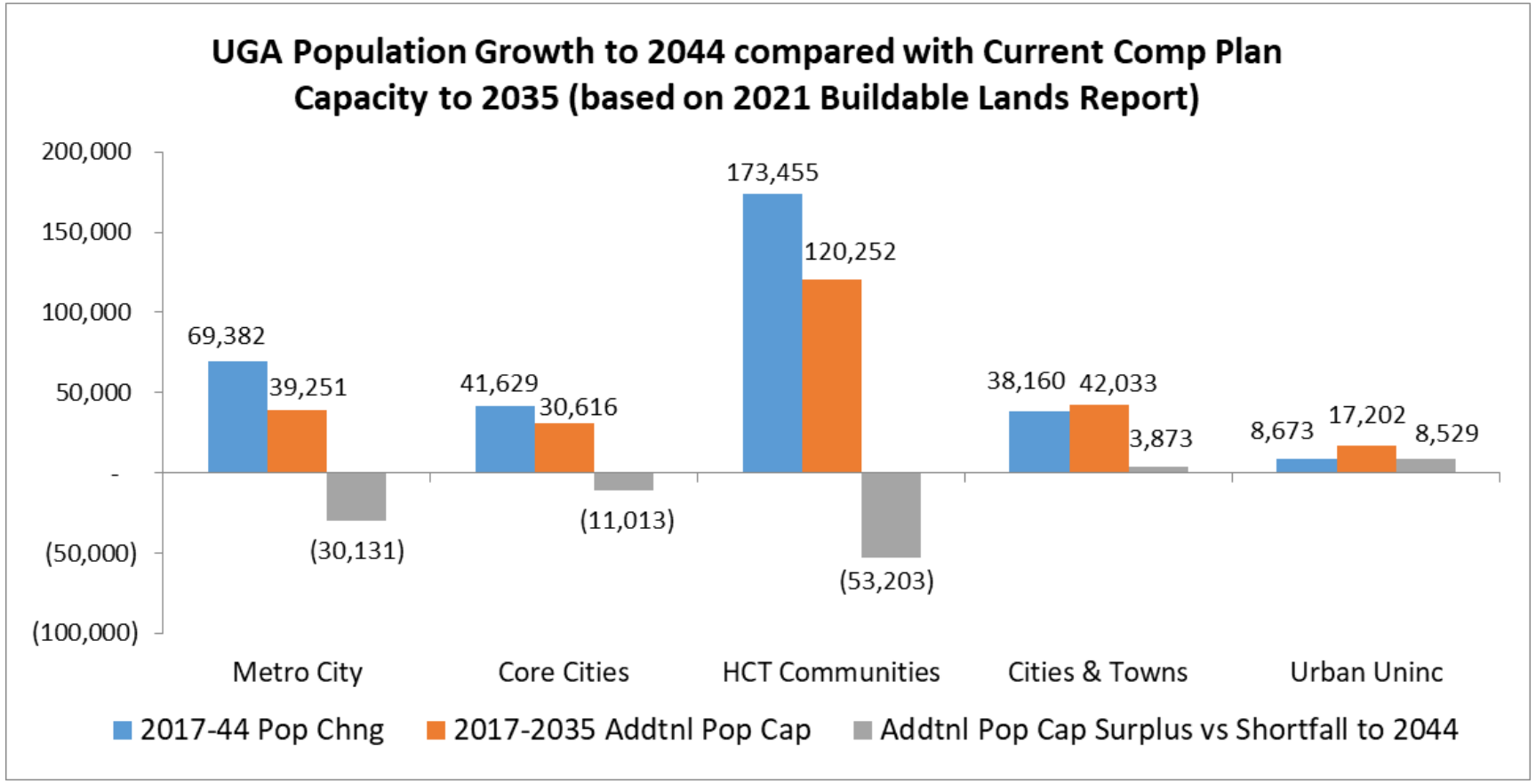
- Total County population of 1,136,309 by 2044 based on PSRC VISION 2050 Regional Growth Strategy (RGS)
- That's a population increase of 291,909 between 2021 and 2044 (844,400 county pop as of April 1, 2021).
- 95.5% of the future population directed to Urban Growth Areas.



Courtesy Snohomish County PDS

Snohomish County

RGS Population Growth to 2044 Compared with BLR Capacity to 2035

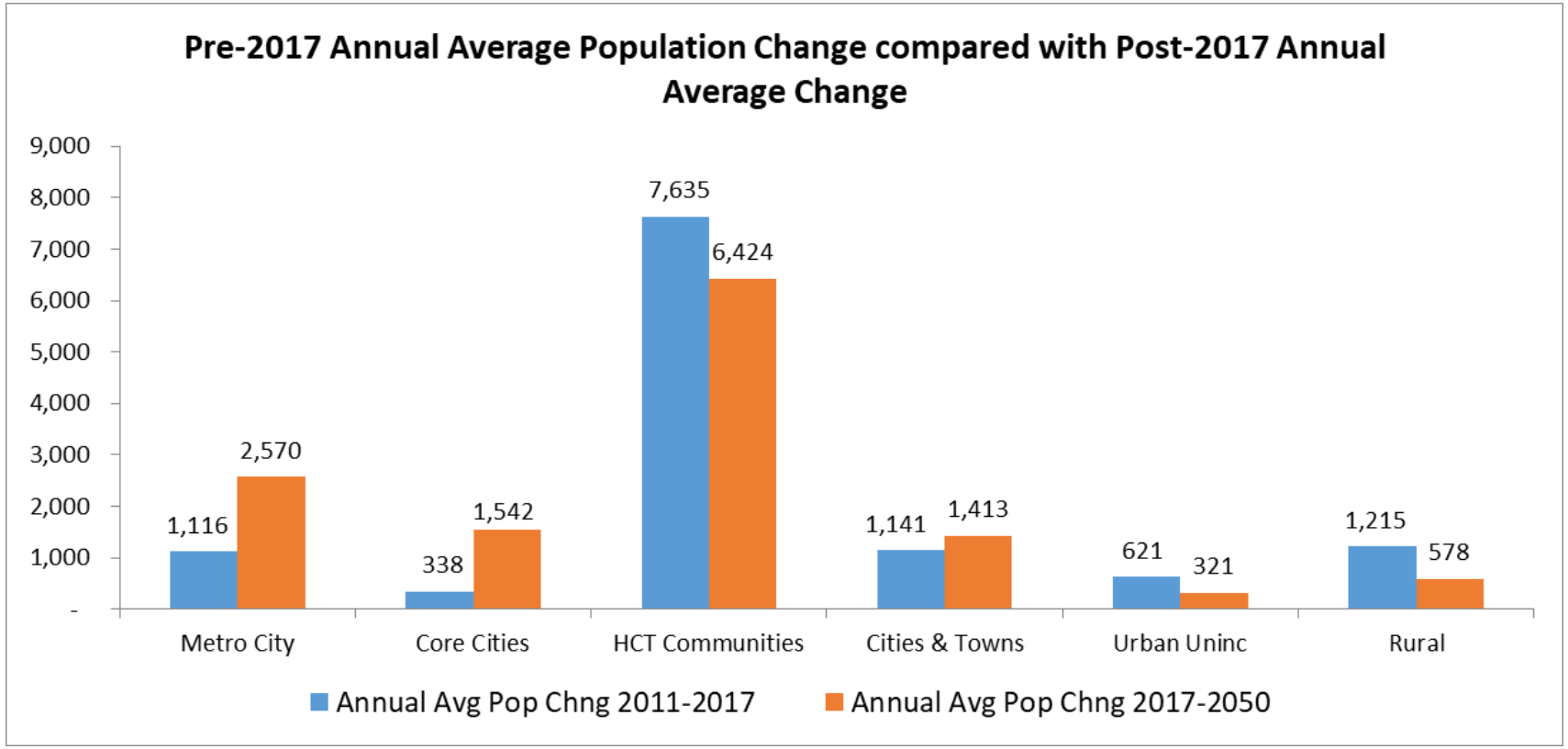


Notes:

- 2044 population is derived from 2017-2050 straight line interpolation.
- Information shown is for current city boundaries as of Aug-26-2021.
- Due to relatively large annexations of portions of the unincorporated UGA into Cities & Towns since 2017, the RGS growth shares were adjusted to 11% for Cities & Towns (up from 9.5%) and 2.5% for Urban Unincorporated (down from 4%).

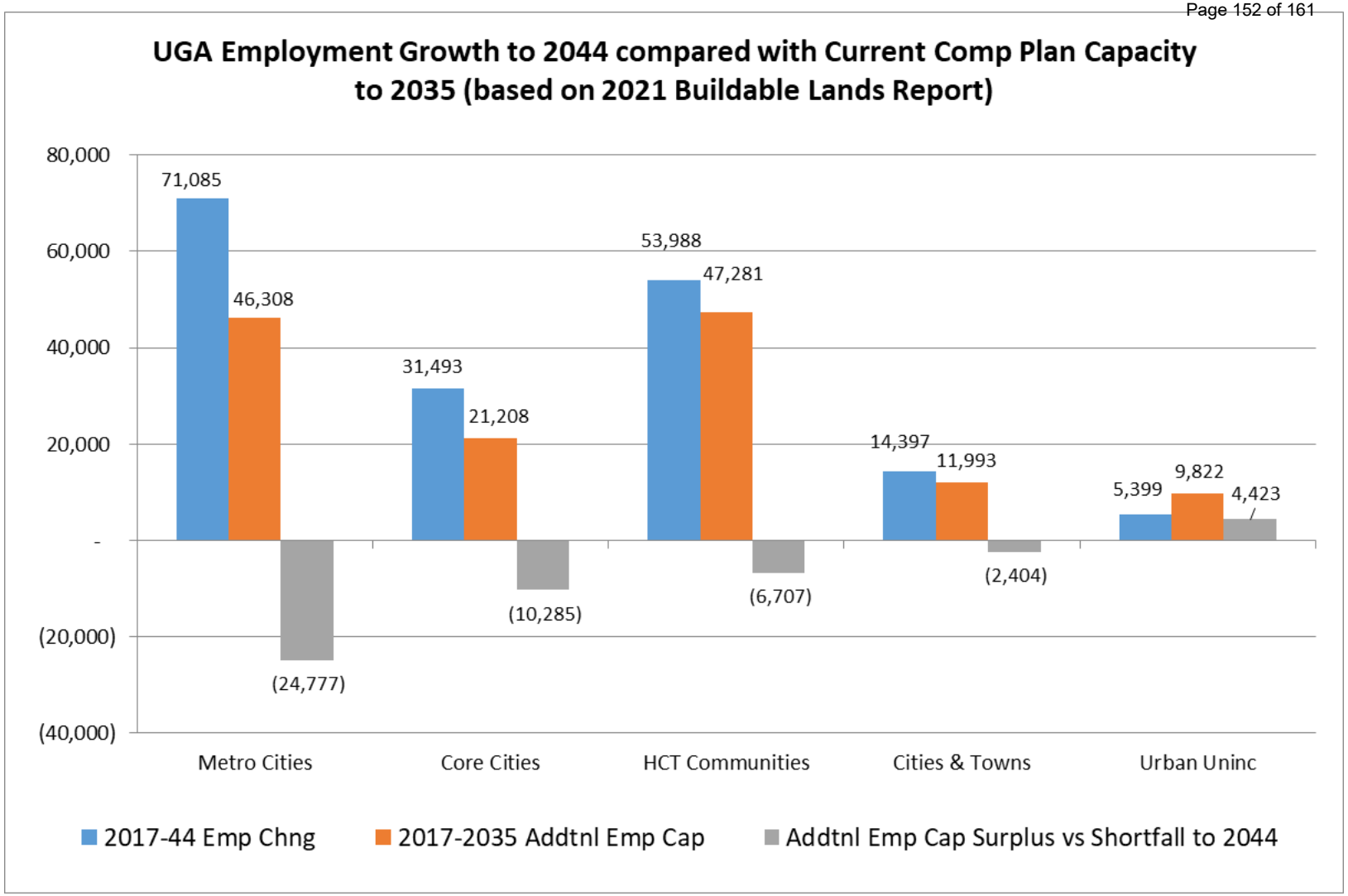
Courtesy Snohomish County PDS

Past Growth Trends and Future Expectations Under RGS



Courtesy Snohomish County PDS

RGS Employment Growth to 2044 Compared with BLR Capacity to 2035

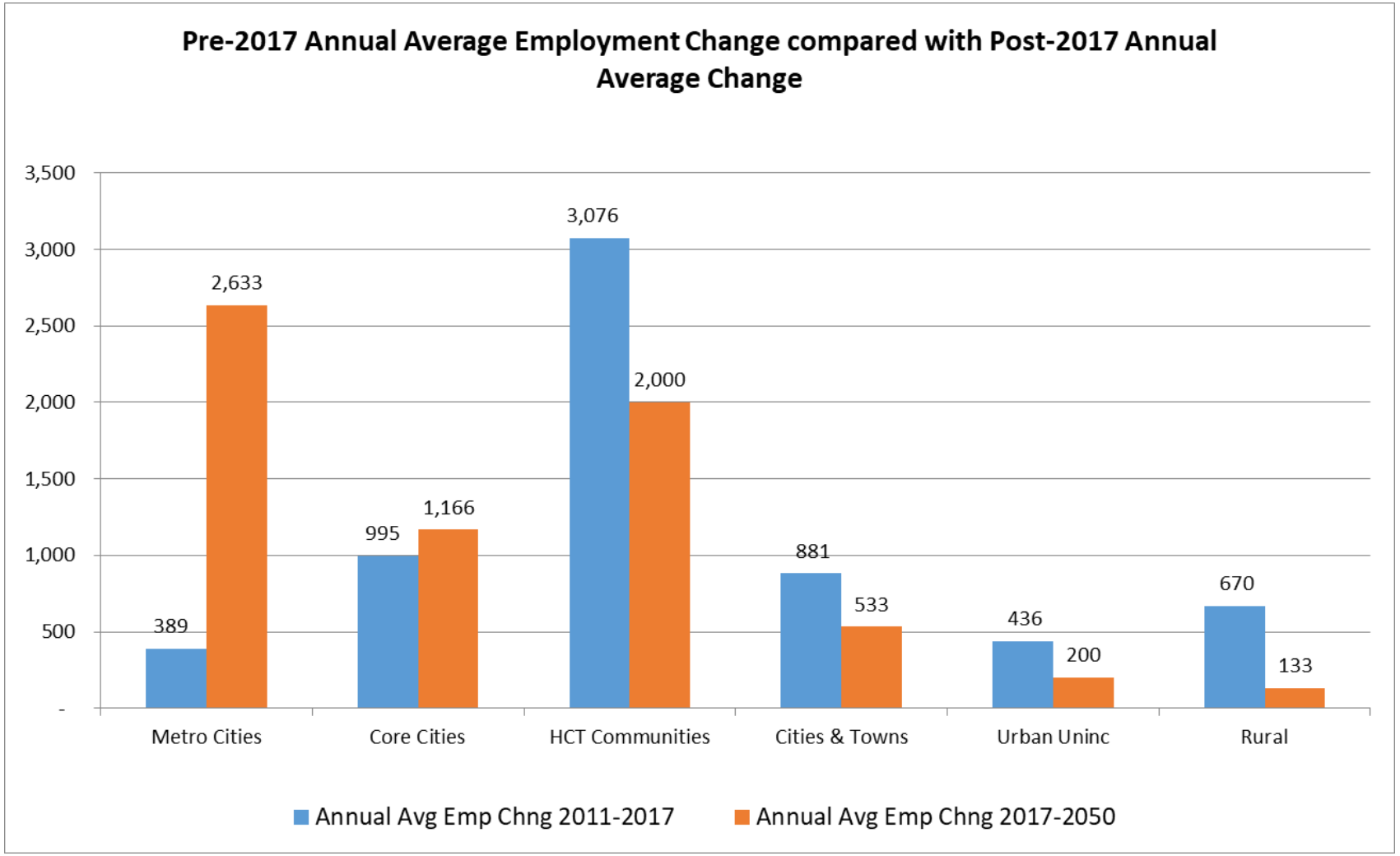


Courtesy Snohomish County PDS

Notes:

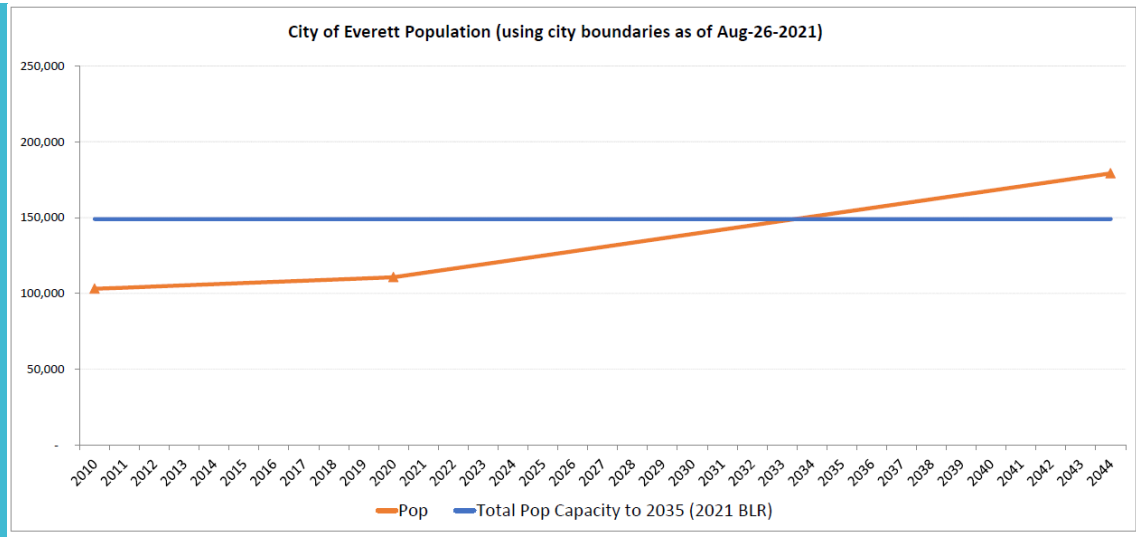
- 2044 employment is derived from 2017-2050 straight line interpolation.
- Information shown is for current city boundaries as of Aug-26-2021.
- Employment estimates and forecasts exclude resource and construction jobs.

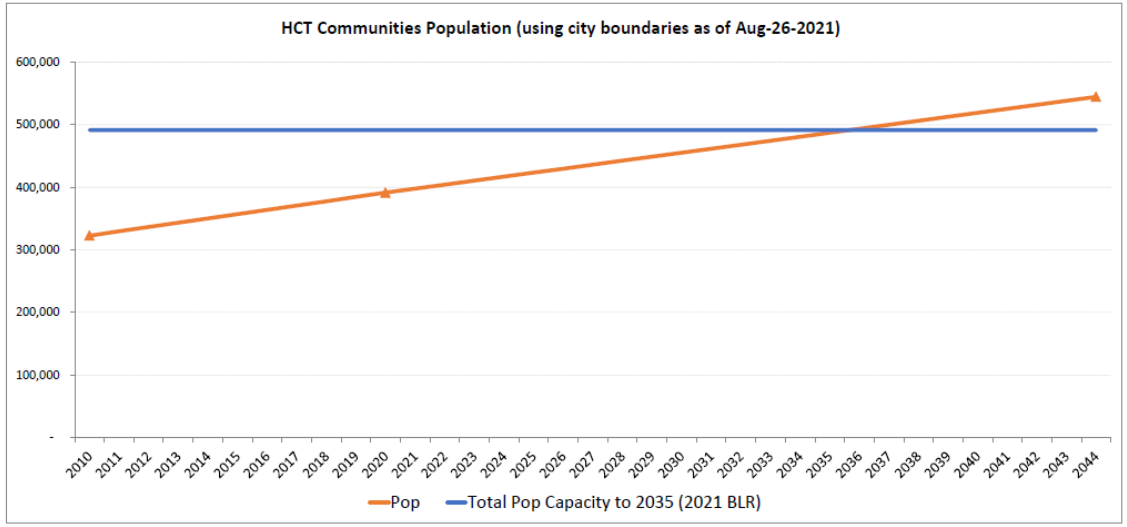
Past Growth Trends and Future Expectations Under RGS

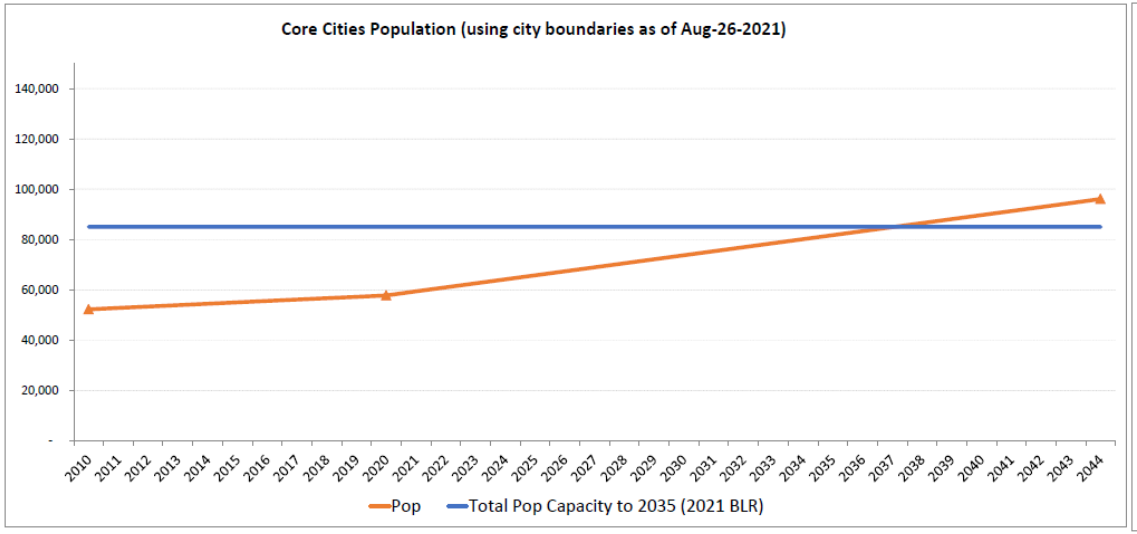


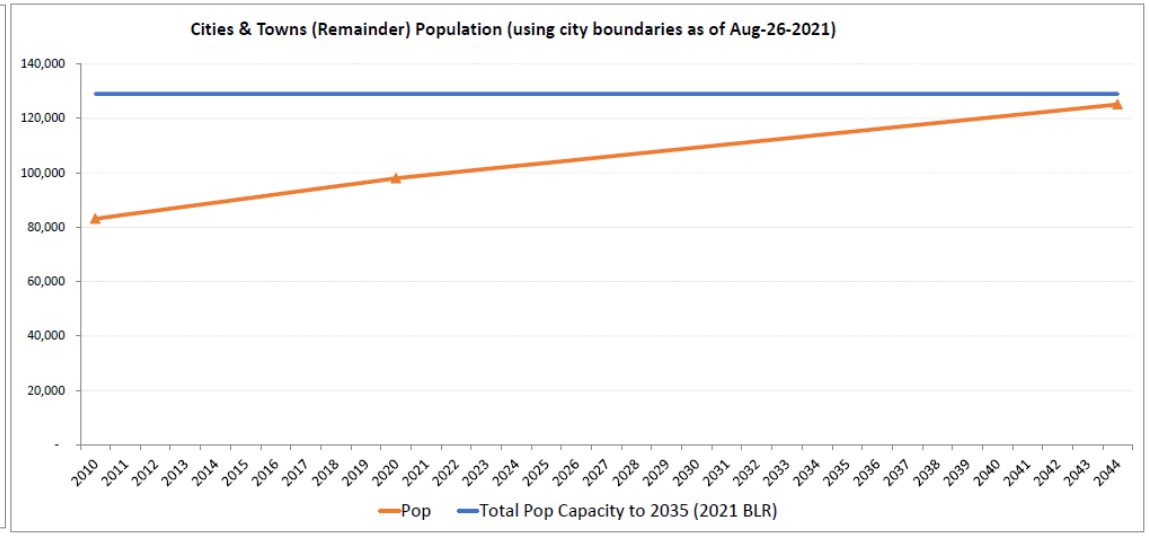
Courtesy Snohomish County PDS

Sample Target Review Graphs







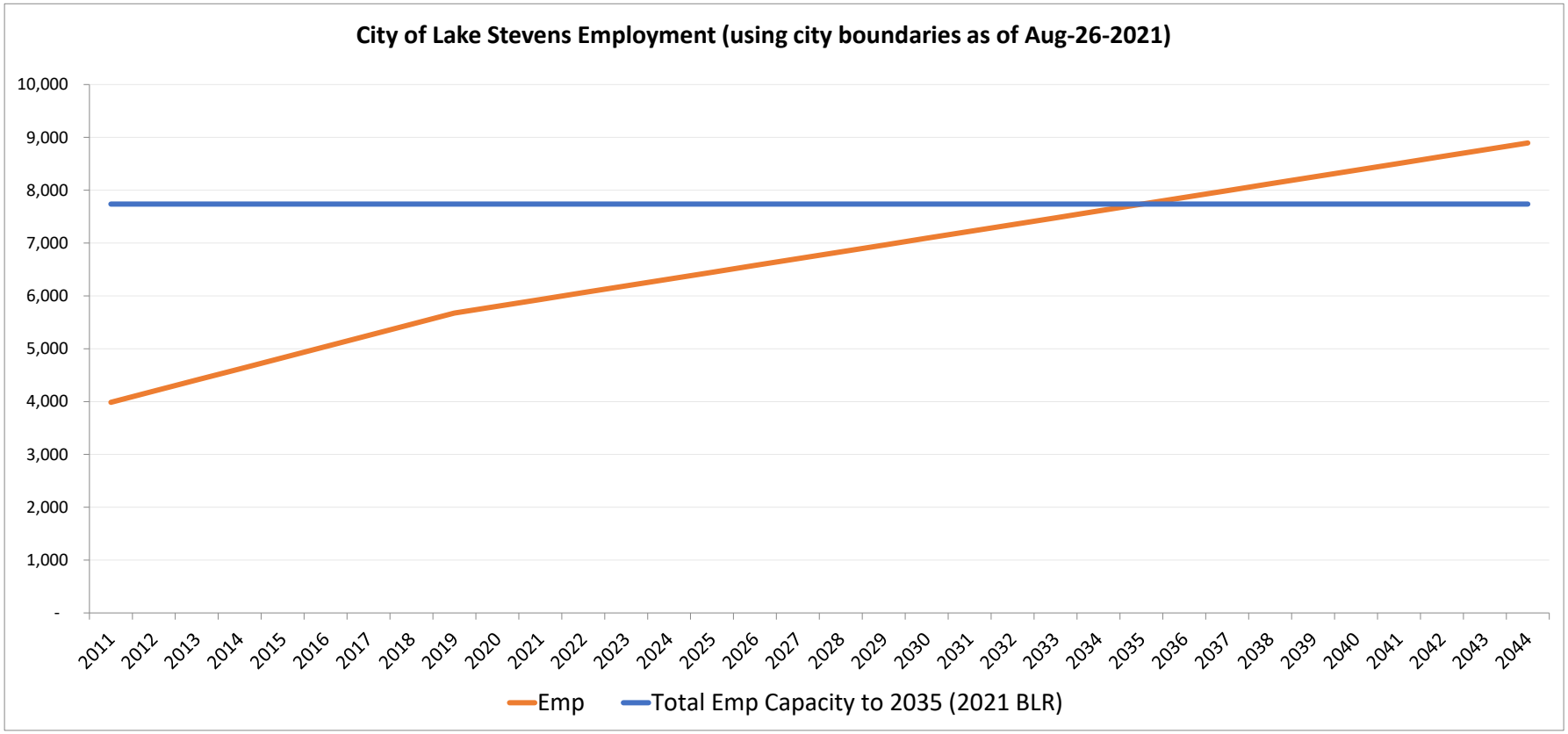


Courtesy Snohomish County PDS

Draft Data Factors for Growth Allocations to Jursdictions within Regional Geographies (for PAC Discussion, Sep 17/2021)

	2020 Census Pop (using Aug-26-2021 city bdys)		2019 Emp Est**		2010-2020 Pop Change (using Aug-26-2021 city bdys)		AHC Pending @ Apr-2019*		# of Light Rail Stations		# of HCT Stations (non-light rail)		# MICs		Access to Jobs (within 30 min. auto travel time)		Average	
Metropolitan City	**110,629**	**100%**	**99,796**	**100%**	**7,604**	**100%**	**6,960**	**100%**	**4**	**100%**	**27**	**100%**	**1**	**100%**	**1.2463**	**100%**	**100%**	
Everett City	110,629	100%	99,796	100%	7,604	100%	6,960	100%	4	100%	27	100%	1	100%	1.246296	100%	100%	
Core Cities	**57,773**	**100%**	**44,710**	**100%**	**5,518**	**100%**	**9,794**	**100%**	**2**	**100%**	**28**	**100%**	**-**	**0%**	**3.1169**	**100%**	**100%**	
Bothell City (Sno Co part)	19,205	33%	16,093	36%	2,790	51%	1,804	18%	0	0%	6	21%			1.600462	51%	30%	
Lynnwood City	38,568	67%	28,617	64%	2,728	49%	7,990	82%	2	100%	22	79%			1.51644	49%	70%	
HCT Communities	**391,465**	**100%**	**90,369**	**100%**	**68,719**	**100%**	**25,619**	**100%**	**7**	**100%**	**55**	**100%**	**2**	**100%**	**17.2954**	**100%**	**100%**	
Arlington City	19,868	5%	10,265	11%	1,906	3%	3,830	15%	0	0%	2	4%	1	50%	0.297025	2%	11%	
Edmonds City	42,853	11%	14,174	16%	3,144	5%	1,212	5%	0	0%	8	15%		0%	1.46362	8%	7%	
Marysville City	70,714	18%	15,310	17%	10,694	16%	3,450	13%	0	0%	8	15%	1	50%	0.487373	3%	16%	
Mill Creek City	20,926	5%	6,787	8%	2,682	4%	892	3%	0	0%	7	13%		0%	1.441167	8%	5%	
Mountlake Terrace City	21,286	5%	8,431	9%	1,377	2%	2,197	9%	1	14%	1	2%		0%	1.689418	10%	6%	
Mukilteo City	21,538	6%	10,313	11%	1,284	2%	284	1%	0	0%	2	4%		0%	1.325885	8%	4%	
Bothell MUGA	34,299	9%	2,221	2%	11,502	17%	2,893	11%	0	0%	2	4%		0%	1.573296	9%	6%	
Edmonds MUGA	4,007	1%	247	0%	402	1%	229	1%	0	0%	1	2%		0%	1.60667	9%	2%	
Everett MUGA	47,690	12%	6,433	7%	6,126	9%	1,755	7%	2	29%	10	18%		0%	1.418991	8%	11%	
Lynnwood MUGA	35,652	9%	5,079	6%	8,505	12%	4,220	16%	1	14%	3	5%		0%	1.536423	9%	9%	
Mill Creek MUGA	52,049	13%	5,780	6%	16,042	23%	2,883	11%	1	14%	6	11%		0%	1.486817	9%	11%	
Mukilteo MUGA	15,584	4%	3,693	4%	3,370	5%	1,010	4%	1	14%	4	7%		0%	1.4308	8%	6%	
Larch Way Overlap	4,999	1%	1,636	2%	1,685	2%	764	3%	1	14%	1	2%		0%	1.53789	9%	4%	
					0													
Cities & Towns (Remainder)	**97,975**	**100%**	**28,639**	**100%**	**14,885**	**100%**	**14,471**	**100%**	**-**	**0%**	**-**	**0%**	**-**	**0%**	**5.1441**	**100%**	**100%**	**100%**
Brier City	6,560	7%	494	2%	318	2%	159	1%	0		0				1.62571	32%	9%	5%
Darrington Town	1,462	1%	522	2%	115	1%	35	0%	0		0				0	0%	1%	1%
Gold Bar City	2,403	2%	250	1%	328	2%	6	0%	0		0				0.04044	1%	1%	1%
Granite Falls City	4,450	5%	971	3%	1,086	7%	1,278	9%	0		0				0.24451	5%	6%	9%
Index Town	155	0%	27	0%	(23)	0%	-	0%	0		0				0.07532	1%	0%	0%
Lake Stevens City	38,951	40%	5,500	19%	7,696	52%	5,263	36%	0		0				0.500135	10%	31%	32%
Monroe City	19,699	20%	10,096	35%	2,374	16%	2,287	16%	0		0				0.337948	7%	19%	16%
Snohomish City	10,126	10%	5,842	20%	1,028	7%	680	5%	0		0				0.91215	18%	12%	10%
Stanwood City	7,705	8%	3,864	13%	1,467	10%	1,659	11%	0		0				0.17582	3%	9%	11%
Sultan City	5,146	5%	1,005	4%	485	3%	2,968	21%	0		0				0.06783	1%	7%	13%
Woodway Town	1,318	1%	68	0%	11	0%	136	1%	0		0				1.16422	23%	5%	3%
Unincorporated UGA (Remainder)	**35,988**	**100%**	**14,416**	**100%**	**4,783**	**100%**	**7,402**	**100%**	**-**	**0%**	**7**	**100%**	**1**	**0%**	**10.3175**	**100%**	**100%**	**100%**
Arlington UGA	550	2%	24	1%	23	0%	29	0%	0		0	0%			0.297025	3%	1%	3%
Brier MUGA	1,828	5%	125	3%	(114)	-2%	67	1%	0		0	0%			1.62571	16%	4%	3%
Darrington UGA	102	0%	-	0%	27	1%	-	0%	0		0	0%			0	0%	0%	1%
Gold Bar UGA	808	2%	7	0%	(40)	-1%	-	0%	0		0	0%			0.04044	0%	0%	0%
Granite Falls UGA	147	0%	-	0%	-	0%	3	0%	0		0	0%			0.24451	2%	0%	2%
Lake Stevens UGA	2,072	6%	232	5%	431	9%	29	0%	0		0	0%			0.5667	5%	4%	3%
Marysville UGA	197	1%	664	15%	34	1%	-	0%	0		0	0%			0.36366	4%	3%	2%
Monroe UGA	1,567	4%	164	4%	111	2%	873	12%	0		0	0%			0.337948	3%	4%	6%
Mountlake Terrace MUGA	23	0%	-	0%	3	0%	-	0%	0		0	0%			1.689418	16%	3%	1%
Snohomish UGA	1,400	4%	268	6%	42	1%	-	0%	0		0	0%			0.91215	9%	3%	6%
Stanwood UGA	142	0%	193	4%	16	0%	110	1%	0		0	0%			0.17582	2%	1%	2%
Sultan UGA	55	0%	-	0%	(250)	-5%	-	0%	0		0	0%			0.06783	1%	-1%	1%
Woodway MUGA	0	0%	-	0%	-	0%	-	0%	0		0	0%			1.16422	11%	2%	2%
Lake Stickney Gap	11,042	31%	911	21%	3,945	84%	1,860	25%	0		2	33%			1.527005	15%	35%	29%
Silver Firs Gap	15,841	44%	1,834	41%	473	10%	4,431	60%	0		4	67%			1.30506	13%	39%	35%
Maltby UGA	164	0%	3,623	NA	32	NA	-	NA	0		0	NA		NA	1.06575	NA	0%	2%
Paine Field Area	50	0%	6,371	NA	50	NA	-	NA	0		1	NA	1	NA	0	0%	0%	0%
UGA Total	**693,830**		**277,930**		**101,509**													
Non-UGA (Rural/Resource)	**134,127**		**17,887**		**13,113**													
Total Snohomish County	**827,957**		**295,817**		**114,622**													

September 17, 2021 DRAFT



	2011 Emp	2019 Emp	2044 Total Emp (V2050 RGS)	Total Emp Capacity to 2035 (2021 BLR)
Lake Stevens City	3,986	5,675	8,894	7,738

2011-2019 Annual Emp Chng	2019-2044 Annual Emp Chng
169	134

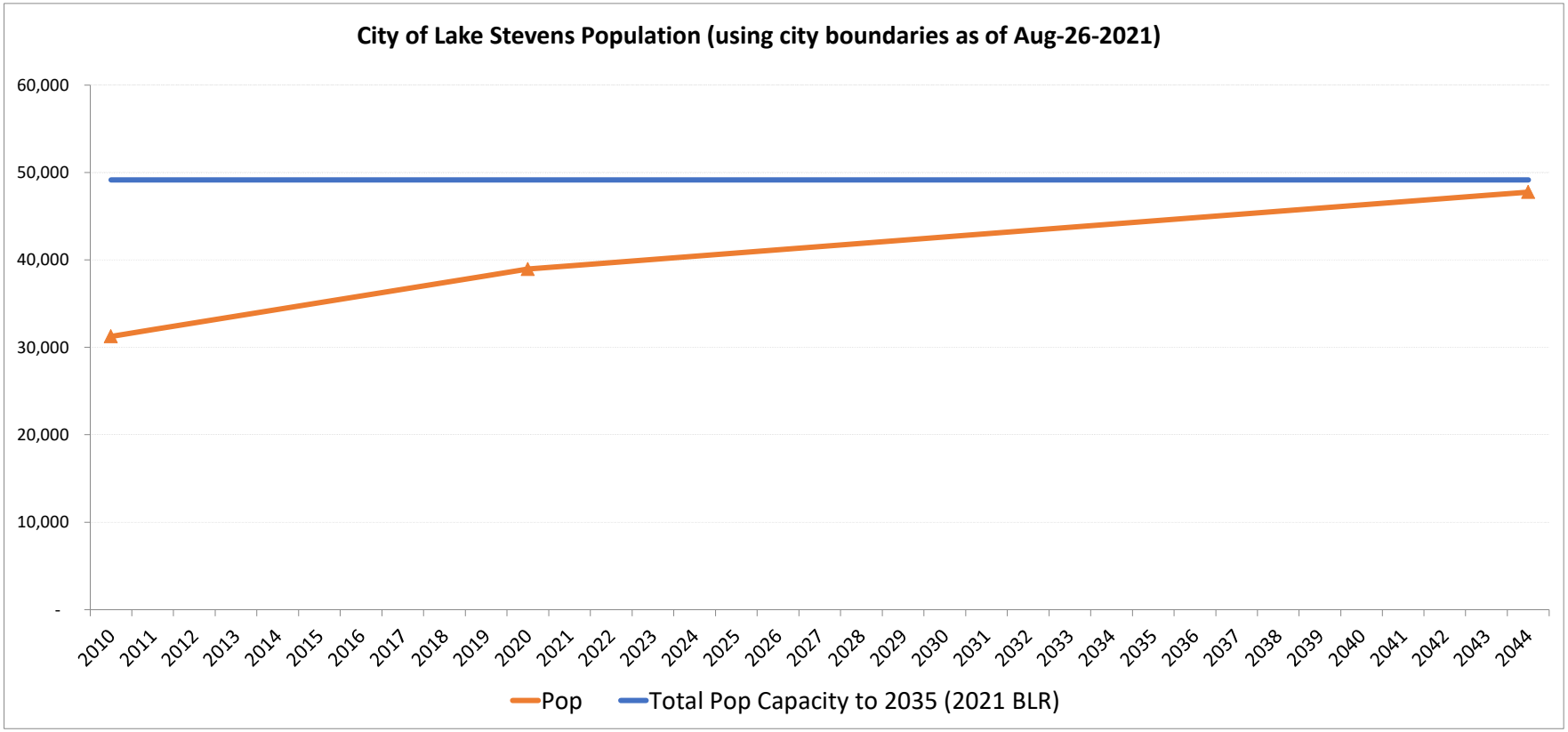
Draft Data Factors for Growth Allocations to Jurisdictions within Regional Geographies (for PAC Discussion, September 17, 2021)

	2020 Census Pop (using Aug-26-2021 city bdys)		2019 Emp Est (using Aug-26-2021 city bdys)*		2011-2019 Emp Change (using Aug-26-2021 city bdys)		AEC Pending @ Apr-2019*		# of Light Rail Stations		# of HCT Stations (non-light rail)		# MICs		Average	
Metropolitan City	**110,629**	**100%**	**99,817**	**100%**	**6,078**	**100%**	**2,326**	**100%**	**4**	**100%**	**27**	**100%**	**1**	**100%**	**100%**	
Everett City	110,629	100%	99,817	100%	6,078	100%	2,326	100%	4	100%	27	100%	1	100%	100%	
Core Cities	**57,773**	**100%**	**44,728**	**100%**	**6,846**	**100%**	**3,653**	**100%**	**2**	**100%**	**28**	**100%**	**-**	**0%**	**100%**	
Bothell City (Sno Co part)	19,205	33%	16,100	36%	2,484	36%	227	6%	0	0%	6	21%			22%	
Lynnwood City	38,568	67%	28,628	64%	4,362	64%	3,426	94%	2	100%	22	79%			78%	
HCT Communities	**391,465**	**100%**	**90,331**	**100%**	**21,060**	**100%**	**13,268**	**100%**	**7**	**100%**	**55**	**100%**	**2**	**100%**	**100%**	
Arlington City	19,868	5%	10,267	11%	1,607	8%	6,955	52%	0	0%	2	4%	1	50%	19%	
Edmonds City	42,853	11%	14,174	16%	2,495	12%	24	0%	0	0%	8	15%		0%	8%	
Marysville City	70,714	18%	15,310	17%	3,646	17%	5,157	39%	0	0%	8	15%	1	50%	22%	
Mill Creek City	20,926	5%	6,787	8%	2,162	10%	161	1%	0	0%	7	13%		0%	5%	
Mountlake Terrace City	21,286	5%	8,431	9%	1,691	8%	492	4%	1	14%	1	2%		0%	6%	
Mukilteo City	21,538	6%	10,313	11%	1,944	9%	74	1%	0	0%	2	4%		0%	4%	
Bothell MUGA	34,299	9%	2,214	2%	834	4%	-	0%	0	0%	2	4%		0%	3%	
Edmonds MUGA	4,007	1%	247	0%	91	0%	-	0%	0	0%	1	2%		0%	1%	
Everett MUGA	47,690	12%	6,412	7%	1,162	6%	-	0%	2	29%	10	18%		0%	10%	
Lynnwood MUGA	35,652	9%	5,067	6%	1,493	7%	24	0%	1	14%	3	5%		0%	6%	
Mill Creek MUGA	52,049	13%	5,780	6%	3,033	14%	46	0%	1	14%	6	11%		0%	9%	
Mukilteo MUGA	15,584	4%	3,693	4%	896	4%	335	3%	1	14%	4	7%		0%	5%	
Larch Way Overlap	4,999	1%	1,636	2%	6	0%	-	0%	1	14%	1	2%		0%	3%	
					0											
Cities & Towns (Remainder)	**97,975**	**100%**	**28,816**	**100%**	**6,742**	**100%**	**636**	**100%**	**-**	**0%**	**-**	**0%**	**-**	**0%**	**100%**	
Brier City	6,560	7%	495	2%	176	3%	-	0%	0		0				3%	
Darrington Town	1,462	1%	522	2%	22	0%	150	24%	0		0				7%	
Gold Bar City	2,403	2%	250	1%	32	0%	-	0%	0		0				1%	
Granite Falls City	4,450	5%	971	3%	211	3%	23	4%	0		0				4%	
Index Town	155	0%	27	0%	7	0%	-	0%	0		0				0%	
Lake Stevens City	38,951	40%	5,675	20%	1,689	25%	429	67%	0		0				38%	
Monroe City	19,699	20%	10,096	35%	2,434	36%	17	3%	0		0				23%	
Snohomish City	10,126	10%	5,842	20%	1,427	21%	-	0%	0		0				13%	
Stanwood City	7,705	8%	3,865	13%	607	9%	17	3%	0		0				8%	
Sultan City	5,146	5%	1,005	3%	139	2%	-	0%	0		0				3%	
Woodway Town	1,318	1%	68	0%	(2)	0%	-	0%	0		0				0%	
Unincorporated UGA (Remainder)	**35,988**	**100%**	**14,237**	**100%**	**2,906**	**100%**	**208**	**100%**	**-**	**0%**	**7**	**100%**	**1**	**0%**	**100%**	**100%**
Arlington UGA	550	2%	22	0%	22	3%	-	0%	0		0	0%			1%	1%
Brier MUGA	1,828	5%	124	3%	55	8%	-	0%	0		0	0%			3%	2%
Darrington UGA	102	0%	-	0%	-	0%	-	0%	0		0	0%			0%	1%
Gold Bar UGA	808	2%	7	0%	2	0%	-	0%	0		0	0%			1%	0%
Granite Falls UGA	147	0%	-	0%	-	0%	-	0%	0		0	0%			0%	0%
Lake Stevens UGA	2,072	6%	57	1%	40	6%	-	0%	0		0	0%			3%	1%
Marysville UGA	197	1%	664	16%	12	2%	-	0%	0		0	0%			4%	2%
Monroe UGA	1,567	4%	164	4%	47	6%	-	0%	0		0	0%			3%	1%
Mountlake Terrace MUGA	23	0%	-	0%	-	0%	-	0%	0		0	0%			0%	0%
Snohomish UGA	1,400	4%	268	6%	(188)	-26%	8	20%	0		0	0%			1%	1%
Stanwood UGA	142	0%	192	5%	(6)	-1%	13	32%	0		0	0%			7%	10%
Sultan UGA	55	0%	-	0%	-	0%	-	0%	0		0	0%			0%	0%
Woodway MUGA	0	0%	-	0%	-	0%	-	0%	0		0	0%			0%	1%
Lake Stickney Gap	11,042	31%	911	21%	217	30%	-	0%	0		2	33%			23%	14%
Silver Firs Gap	15,841	44%	1,834	43%	523	72%	20	49%	0		4	67%			55%	28%
Maltby UGA	164	0%	3,623	NA	433	NA	167	NA	0		0	NA		NA	0%	19%
Paine Field Area	50	0%	6,371	NA	1,749	NA	-	NA	0		1	NA	1	NA	0%	19%
UGA Total	**693,830**		**277,930**		**43,632**											
Non-UGA (Rural/Resource)	**134,127**		**17,887**		**3,195**											
Total Snohomish County	**827,957**		**295,817**		**46,827**											

Some columns may not add due to rounding.

*Suppressed values in unincorporated urban areas zeroed out and added to city values to match previously published UGA and MUGA totals.

September 17, 2021 DRAFT



	2010 Census Pop	2020 Census Pop	2044 Total Pop (V2050 RGS)	Total Pop Capacity to 2035 (2021 BLR)
Lake Stevens City	31,255	38,951	47,770	49,148

2010-2020 Annual Pop Chng	2020-2044 Annual Pop Chng
770	367

Preliminary Draft Employment Growth Allocations to Jurisdictions within Regional Geographies (for PAC Discussion, Sept 17, 2021)

	2019 Emp (using Aug-26-2021 city bdys)*	2011 GMR Emp Est (Dec-13-2012 city bdys)*	2011 Emp in areas annexed after Dec-13-2012**	2011 Emp (using Aug-26-2021 city bdys)*	2019-2035 Addtnl Emp Capacity @ Dec-13-2012 City bdys (Final Draft 2021 BLR)	2019-2035 Addtnl Emp Capacity in areas annexed Dec-13-2012 thru Aug-26-2021 (Final Draft 2021 BLR)	2019-2035 Addtnl Emp Capacity in current City bdys (Final Draft 2021 BLR)	% Distr	Total 2035 Emp Capacity using current City bdys (Final Draft 2021 BLR)	Prelim 2044 Emp	2019-2044 Emp Change
Metropolitan City	**99,817**	**93,739**		**93,739**	**41,279**		**42,563**		**142,380**	**167,157**	**67,340**
Everett City	99,817	93,739		93,739	41,279	1,284	42,563		142,380	167,157	67,340
Core Cities	**44,728**	**37,882**		**37,882**	**20,331**		**20,331**		**65,059**	**75,344**	**30,616**
Bothell City (Sno Co part)	16,100	13,616		13,616	6,422		6,422		22,522	24,805	8,705
Lynnwood City	28,628	24,266		24,266	13,909		13,909		42,537	50,540	21,912
HCT Communities	**90,331**	**69,271**		**69,271**	**45,958**		**44,674**		**135,005**	**141,712**	**51,381**
Arlington City	10,267	8,660		8,660	13,176		13,176		23,443	24,690	14,423
Edmonds City	14,174	11,679		11,679	2,548		2,548		16,722	17,232	3,058
Marysville City	15,310	11,664		11,664	16,124		16,124		31,434	32,926	17,616
Mill Creek City	6,787	4,625		4,625	381		381		7,168	7,523	736
Mountlake Terrace City	8,431	6,740		6,740	2,309		2,309		10,740	11,148	2,717
Mukilteo City	10,313	8,369		8,369	2,067		2,067		12,380	12,671	2,358
Bothell MUGA	2,214	1,380		1,380	362		362		2,576	2,756	542
Edmonds MUGA	247	156		156	72		72		319	353	106
Everett MUGA	6,412	5,250		5,250	2,503	(1,284)	1,219		7,631	8,317	1,905
Lynnwood MUGA	5,067	3,574		3,574	2,542		2,542		7,609	8,009	2,942
Mill Creek MUGA	5,780	2,747		2,747	1,028		1,028		6,808	7,379	1,599
Mukilteo MUGA	3,693	2,797		2,797	2,539		2,539		6,232	6,581	2,888
Larch Way Overlap	1,636	1,630		1,630	307		307		1,943	2,127	491
Cities & Towns (Remainder)* **	**28,816**	**22,020**		**22,074**	**10,057**		**10,463**		**39,279**	**41,086**	**12,270**
Brier City	495	319		319	30		30		525	609	114
Darrington Town***	522	500		500	1,372	150	1,522		2,044	1,015	493
Gold Bar City	250	218		218	562		562		812	841	591
Granite Falls City	971	760		760	1,043		1,043		2,014	2,126	1,155
Index Town	27	20		20	-		-		27	30	3
Lake Stevens City	5,675	3,932	54	3,986	1,807	256	2,063		7,738	8,894	3,219
Monroe City	10,096	7,662		7,662	1,609		1,609		11,705	12,420	2,324
Snohomish City	5,842	4,415		4,415	1,430		1,430		7,272	7,666	1,824
Stanwood City	3,865	3,258		3,258	957		957		4,822	5,073	1,208
Sultan City	1,005	866		866	1,247		1,247		2,252	2,334	1,329
Woodway Town	68	70		70	-		-		68	80	12
Unincorporated UGA (Remainder)	**14,237**	**11,385**		**11,331**	**10,015**		**9,609**		**23,846**	**20,020**	**5,783**
Arlington UGA	22	-		-	53		53	1%	75	61	39
Brier MUGA	124	69		69	-		-	0%	124	205	81
Darrington UGA	-	-		-	427	(150)	277	3%	277	76	76
Gold Bar UGA	7	5		5	-		-	0%	7	21	14
Granite Falls UGA	-	-		-	3		3	0%	3	3	3
Lake Stevens UGA	57	71	(54)	17	256	(256)	-	0%	57	122	65
Marysville UGA	664	652		652	-		-	0%	664	757	93
Monroe UGA	164	117		117	1		1	0%	165	241	77
Mountlake Terrace MUGA	-	-		-	-		-	0%	-	0	0
Snohomish UGA	268	456		456	64		64	1%	332	305	37
Stanwood UGA	192	198		198	1,290		1,290	13%	1,482	726	534
Sultan UGA	-	-		-	-		-	0%	-	1	1
Woodway MUGA	-	-		-	119		119	1%	119	32	32
Lake Stickney Gap	911	694		694	402		402	4%	1,313	1,618	707
Silver Firs Gap	1,834	1,311		1,311	32		32	0%	1,866	3,268	1,434
Maltby UGA	3,623	3,190		3,190	3,729		3,729	39%	7,352	4,629	1,006
Paine Field Area***	6,371	4,622		4,622	3,639		3,639	38%	10,010	7,955	1,584
UGA Total	**277,929**	**234,297**		**234,297**	**127,640**		**127,640**		**405,569**	**445,320**	**167,391**
Non-UGA (Rural/Resource)	**17,887**	**14,690**		**14,690**						**22,314**	**4,427**
Total Snohomish County	**295,817**	**248,990**		**248,990**						**467,634**	**171,817**

Some columns may not add due to rounding.

*Suppressed values in unincorporated urban areas zeroed out and added to city values to match previously published UGA and MUGA totals.

**Suppressed values ignored.

***The standard formula over-allocated employment growth to Town of Darrington based on large additional employment capacity. Original value was adjusted based on a linear extrapolation from 2019 through the adopted 2035 employment target for the Darrington UGA out to 2044, minus the 2044 unincorporated Darrington UGA target. This resulted in 1,193 jobs growth being re-allocated away from Darrington, with half shifted to the unincorporated Paine Field MUGA (an MIC otherwise under-allocated by the methodology based on its status as an unaffiliated unincorporated urban area), and the other half re-allocated to the other Cities and Towns in proportion to their data factor averages. This shifted 243 jobs growth to Lake Stevens, 150 to Monroe, 83 to Snohomish, 53 to Stanwood, 23 to Granite Falls, 18 to Brier, 17 to Sultan, 6 to Gold Bar, 2 to Woodway, and 1 to Index.

Preliminary Draft Population Growth Allocations to Jursdictions within Regional Geographies (for PAC Discussion, Sep 17/2021)

	2020 Census Pop *	2020 Census Pop Annexed since Jan-1-2020 **	2020 Census Pop (using Aug-26-2021 city bdys)	2010 Census Pop (using Aug-26-2021 city bdys)	2019 GMR Pop Est (Dec-13-2012 city bdys)	2020 GMR Pop Est (Dec-13-2012 city bdys)	2019-2020 GMR Pop Growth (excluding annexed pop)	Revised April 1, 2019 Pop Estimate for 2021 BLR Base using Current Aug-26-2021 City Bdys	2019-2035 Addtnl Pop Capacity @ Dec-13-2012 City bdys (Final Draft 2021 BLR)	2019-2035 Addtnl Pop Capacity in areas annexed Dec-13-2012 thru Jun-23-2021 (Final Draft 2021 BLR)	2019-2035 Addtnl Pop Capacity in areas annexed since Jun-23-2021 (Final Draft 2021 BLR)	2019-2035 Addtnl Pop Capacity in current City bdys (Final Draft 2021 BLR)	% Distr	Total 2035 Pop Capacity using current City bdys (Final Draft 2021 BLR)	V2050 Pop Surplus/ Deficit as of 2044	Prelim 2044 Pop	2020-2044 Pop Change
Metropolitan City	**110,629**		**110,629**	**103,025**	**111,794**	**112,694**	**900**	**109,729**	**39,269**			**39,316**		**149,045**	**(30,131)**	**179,176**	**68,547**
Everett City	110,629		110,629	103,025	111,794	112,694	900	109,729	39,269	47		39,316		149,045		179,176	68,547
Core Cities	**57,773**		**57,773**	**52,255**	**57,776**	**59,356**	**1,580**	**56,193**	**28,726**			**28,883**		**85,076**	**(11,013)**	**96,089**	**38,316**
Bothell City (Sno Co part)	19,205		19,205	16,415	18,180	18,670	490	18,715	10,177	143		10,320		29,035		32,355	13,150
Lynnwood City	38,568		38,568	35,840	39,596	40,686	1,090	37,478	18,549	14		18,563		56,041		63,735	25,167
HCT Communities	**391,465**		**391,465**	**322,746**	**387,793**	**392,460**	**4,668**	**386,797**	**104,617**			**104,706**		**491,503**	**(53,203)**	**544,706**	**153,241**
Arlington City	19,868		19,868	17,962	19,734	20,594	860	19,008	14,257	293		14,550		33,558		39,511	19,643
Edmonds City	42,853		42,853	39,709	42,170	42,470	300	42,553	9,493			9,493		52,046		55,966	13,113
Marysville City	70,714		70,714	60,020	67,820	69,180	1,360	69,354	21,730			21,730		91,084		99,822	29,108
Mill Creek City	20,926		20,926	18,244	20,590	20,590	-	20,926	1,126	14		1,140		22,066		24,813	3,887
Mountlake Terrace City	21,286		21,286	19,909	21,590	21,660	70	21,216	10,088			10,088		31,304		34,710	13,424
Mukilteo City	21,538		21,538	20,254	21,350	21,360	10	21,528	1,014			1,014		22,542		24,616	3,078
Bothell MUGA	34,299		34,299	22,797	33,861	34,559	698	33,601	8,311	(143)		8,168		41,769		45,226	10,927
Edmonds MUGA	4,007		4,007	3,605	3,993	4,000	8	3,999	852			852		4,851		5,774	1,767
Everett MUGA	47,690		47,690	41,564	46,829	46,995	166	47,524	9,360	(47)		9,313		56,837		62,823	15,133
Lynnwood MUGA	35,652		35,652	27,147	36,327	36,499	171	35,481	13,165	(14)		13,151		48,632		53,433	17,781
Mill Creek MUGA	52,049		52,049	36,007	52,557	53,255	698	51,351	7,659	(14)		7,645		58,996		64,854	12,805
Mukilteo MUGA	15,584		15,584	12,214	15,254	15,334	80	15,504	4,577			4,577		20,081		23,190	7,606
Larch Way Overlap	4,999		4,999	3,314	5,718	5,965	247	4,752	2,985			2,985		7,737		9,966	4,967
Cities & Towns (Remainder)	**94,654**	**3,321**	**97,975**	**83,090**	**90,286**	**92,537**	**2,251**	**95,724**	**27,819**			**33,253**		**128,977**	**3,873**	**125,104**	**27,129**
Brier City	6,560		6,560	6,242	6,611	6,706	95	6,465	463	5		468	1%	6,933		7,943	1,383
Darrington Town	1,462		1,462	1,347	1,410	1,420	10	1,452	360			360	1%	1,812		1,738	276
Gold Bar City	2,403		2,403	2,075	2,150	2,195	45	2,358	199			199	1%	2,557		2,633	230
Granite Falls City	4,450		4,450	3,364	3,900	4,425	525	3,925	3,945			3,945	12%	7,870		6,514	2,064
Index Town	155		155	178	175	175	-	155	33			33	0%	188		215	60
Lake Stevens City	35,630	3,321	38,951	31,255	33,057	33,578	521	38,430	7,534	1,595	1,589	10,718	32%	49,148		47,770	8,819
Monroe City	19,699		19,699	17,325	19,250	19,800	550	19,149	4,423			4,423	13%	23,572		23,855	4,156
Snohomish City	10,126		10,126	9,098	10,200	10,240	40	10,086	2,800			2,800	8%	12,886		13,088	2,962
Stanwood City	7,705		7,705	6,238	7,013	7,118	105	7,600	3,619	445		4,064	12%	11,664		10,750	3,045
Sultan City	5,146		5,146	4,661	5,170	5,520	350	4,796	4,374	1,696		6,070	18%	10,866		8,472	3,326
Woodway Town	1,318		1,318	1,307	1,350	1,360	10	1,308	69	104		173	1%	1,481		2,126	808
Unincorporated UGA (Remainder)	**39,309**	**(3,321)**	**35,988**	**31,205**	**39,708**	**40,644**	**936**	**35,052**	**26,249**			**20,522**		**55,574**	**8,529**	**47,077**	**11,089**
Arlington UGA	550		550	527	562	559	(2)	552	1,231	(293)		938	5%	1,490		885	335
Brier MUGA	1,828		1,828	1,942	2,163	2,182	19	1,809	318	(5)		313	2%	2,122		2,123	295
Darrington UGA	102		102	75	81	81	(1)	103	350			350	2%	453		213	111
Gold Bar UGA	808		808	848	951	948	(4)	812	53			53	0%	865		847	39
Granite Falls UGA	147		147	147	160	160	(0)	147	620			620	3%	767		357	210
Lake Stevens UGA	5,393	(3,321)	2,072	1,641	5,956	6,051	95	1,977	3,694	(1,595)	(1,589)	510	2%	2,487		2,387	315
Marysville UGA	197		197	163	238	237	(1)	198	-			-	0%	198		396	199
Monroe UGA	1,567		1,567	1,456	1,576	1,710	135	1,432	1,665			1,665	8%	3,097		2,174	607
Mountlake Terrace MUGA	23		23	20	20	20	-	23	19			19	0%	42		193	170
Snohomish UGA	1,400		1,400	1,358	1,450	1,447	(4)	1,404	1,954			1,954	10%	3,358		2,171	771
Stanwood UGA	142		142	126	136	139	3	139	1,176	(445)		731	4%	870		436	294
Sultan UGA	55		55	305	349	346	(3)	58	2,407	(1,696)		711	3%	769		221	166
Woodway MUGA	-		-	-	-	-	-	-	647	(104)		543	3%	543		271	271
Lake Stickney Gap	11,042		11,042	7,097	10,365	11,066	701	10,341	4,954			4,954	24%	15,295		13,874	2,832
Silver Firs Gap	15,841		15,841	15,368	15,700	15,700	(0)	15,841	6,311			6,311	31%	22,152		20,034	4,193
Maltby UGA	164		164	132			-	164	850			850	4%	1,014		440	276
Paine Field Area	50		50	-	-	-	-	50	-			-	0%	50		54	4
UGA Total	**693,830**		**693,830**	**592,321**	**687,356**	**697,692**	**10,335**	**683,495**	**226,680**			**226,680**		**910,175**		**992,151**	**298,321**
Non-UGA (Rural/Resource)	**134,127**		**134,127**	**121,014**	**131,343**	**132,808**	**1,465**	**132,662**								**144,190**	**10,063**
Total Snohomish County	**827,957**		**827,957**	**713,335**	**818,700**	**830,500**	**11,801**	**816,156**								**1,136,341**	**308,384**

* All jurisdictional boundaries used for the 2020 Census are those reported to the Census Bureau to be in effect as of January 1, 2020.
** The City of Lake Stevens annexed the Machias Industrial Area (effective March 3, 2021) and the Southeast Interlocal Agreement Area (effective August 9, 2021) after Jan-1-2020

Draft Growth Targets

2021		2044		
Pop. Estimate	Empl. Estimate	Pop. Capacity	Reconciled Pop. Target	Job Target
38,951	5,500	10,718	47,770	8,651