WELCOME!

Quartermaster Harbor
Nitrogen Loading Study
Phase One Findings

Vashon High School
Wednesday, October 6, 2010

www.KingCounty.gov/QMHnitrogenstudy
Quartermaster Harbor Focus of Many Federal Agencies and Puyallup Tribe

- U.S. Environmental Protection Agency (EPA) Region 10
- Puyallup Tribe shellfish harvest
- National Oceanic and Atmospheric Administration (NOAA) Sound Toxins
Quartermaster Harbor Focus of Many State Agencies and Nonprofits

- WA Ecology ambient monitoring
- WA Department of Health (DOH) shellfish program
- WA Department of Natural Resources (DNR)
- WA Fish and Wildlife
- Puget Sound Restoration Fund mussel raft study
Quartermaster Harbor Focus of University Studies

- UWT *Alexandrium* study – Cheryl Greengrove
- UWT geoduck larvae study – Bonnie Becker
Quartermaster Harbor Focus of King County Agencies

- Public Health-Seattle King County (PH-SKC) Marine Recovery Area
- King County Rural Effectiveness Monitoring Study
Quartermaster Harbor Focus of Local Community Government, Volunteers and Citizens

- Vashon High School science program
- Lowtide Celebration
- Citizen beach monitors
- Septic Solutions subcommittee
- Groundwater Protection Committee
- Vashon-Maury Island Land Trust
- Concerned property owners
Quartermaster Harbor Nitrogen Management Study

- Study partners/team
- Study Area - Project Need
- Water Quality concern
- Study goals/Phases
- Monitoring
Project Partners

- EPA Region 10 Watershed Grant Program
- King County Department of Natural Resources, Water and Land Resources
- University of Washington Tacoma, Environmental Science
- Department of Ecology, Marine Monitoring
- Vashon-Maury Island Groundwater Protection Committee
Partner Roles

- EPA – $625K grant 2009 through 2012
- KC – Marine/stream/groundwater monitoring; N loading input; $268K match
- U of W Tacoma – marine monitoring and environmental science expertise
- Ecology – Model and simulate effect of N on dissolved oxygen in QH
- VMI GWPC – Outreach and evaluation
Study Team

- Curtis DeGasperi – Project Manager, KC
- Eric Ferguson – Surface/Groundwater monitor, KC
- Kim Stark – Marine monitoring, KC
- Cheryl Greengrove – Environmental Science, UWT
- Julie Masura – Researcher, UWT
- Skip Albertson – Marine Modeler, Ecology
- Larry Stockton – Public Outreach, KC
Study Area – Project Motivation

- Vashon-Maury Island
- Population 10,000
- Zoned rural
- ~40 percent of island drains to harbor
- Low dissolved oxygen observed in harbor
- QMH part of Marine Reserve (WA DNR) and Marine Recovery Area (PH-SKC)
WA DNR Marine Reserve and PH-SKC Marine Recovery Area
Water Quality Concerns

- Observed levels of dissolved oxygen near critical low levels in late summer/early fall
- Shellfish & other marine organisms at risk
- Similar problems observed in studies on Hood Canal and in South Puget Sound
- Nitrogen loading in streams/ground on Vashon-Maury Island
Marine Dissolved Oxygen Dynamics

Quartermaster Harbor Study Goals

- Evaluate the role of nitrogen loading to risk of low-level dissolved oxygen in QMH
- Identify & quantify N loading sources
- Model impacts of N on dissolved oxygen
- Identify & evaluate management strategies & costs
- Develop management recommendations working with stakeholders
QMH N Study Phases
2009 through 2012

- Phase 1  Estimate N loading from existing data, published literature and sampling streams, ground and marine waters.
- Phase 2  Model the nitrogen loadings to QH & develop receiving water model
- Phase 3  Link N loading to QH oxygen level, simulate effect of N mgt scenarios and develop N mgt recommendations.
QMHN Study Outputs

• Quality Assurance Project Plan
• Nitrogen Loadings report (estimate & survey)
• Water Quality Assessment report
• Benthic Flux Study
• Source Tracing Monitoring Plan (Mileta & others)
• Quartermaster Harbor model and documentation
• Evaluation of N management options
• Recommend policy and/or regulatory changes
• Public Outreach and Education (meetings, webpage, etc)
Sources of Nitrogen to Quartermaster Harbor

- Streams
- Nearshore
- Septics
- Atmosphere
- Sediment
- Marine Boundary
- Groundwater
Sources of Nitrogen on VMI

- Atmosphere
- Septics
- Livestock
- Fertilizer
- Alders
Dissolved Inorganic Nitrogen Load

Annual DIN Loading to Quartermaster Harbor

- Atmospheric: 13%
- Stream Inputs: 63%
- Groundwater: 17%
- Nearshore Septics: 7%
Groundwater Monitoring Sites — long term

- 19 long term monitoring sites — 8 sites within study area

- Monitoring water quality since 2001

- As part of the Water Resources Evaluation Project
Groundwater Monitoring Sites — monitoring wells

- 10 Monitoring well locations — 7 sites within study area
- Monitoring water quality since 2007
- As part of the Water Resources Evaluation Project
Stream Monitoring Sites

- 4 Active stream WQ sites - 3 sites within study area
- Monitoring water quality since 2006
- As part of the Water Resources Evaluation Project
Mileta Creek Nitrogen Source Tracking Study
Quartermaster Harbor Nearshore Freshwater Assessment Study

Proposed to collect 40 samples from 21 areas.

Sampling for nitrogen compounds
- Total Nitrogen, Nitrate and Ammonia
Developing a harbor model -

- Create horizontal and vertical geometry
Developing a harbor model -

- Create horizontal and vertical geometry
- \( F = ma, \) \( F = \) Forcings (as follows):
Boundary Conditions:

Temperature, Salinity, Oxygen, Nitrate, etc.

Tide forcing (slightly different in each cell)
Boundary Conditions:

Flow, Temperature, Nitrate, etc.

Freshwater input from streams and tributaries
Some results: salinity (psu)
Nitrogen Management Strategies

- Today education backed with regulations
- Update based on loading study outcomes
- Near term outline improved strategies to improve implementation of existing rules
- Longer term consider option to limit Total Maximum Daily Loading (TMDL)
- Goal to protect water quality in streams, ground (sole source aquifer) and Harbor
Dissolved Inorganic Nitrogen Load

Annual DIN Loading to Quartermaster Harbor

- Atmospheric: 10.9, 17%
- Stream Inputs: 40.0, 63%
- Groundwater: 8.0, 13%
- Nearshore Septics: 4.7, 7%

Legend:
- Atmospheric
- Stream Inputs
- Groundwater
- Nearshore Septics
Sources of Nitrogen on VMI

- Atmosphere
- Septics
- Livestock
- Fertilizer
- Alders
Nitrogen Management Code

Critical Aquifer Recharge Areas 1&2 N Reduction For OSS < ½ Acre
Other Codes affecting N loading

- **On-Site Sewage**
- Livestock
- Stormwater
- **Public Benefit Rating System**
Near Term Strategy Options

• Revise CARA to require N reduction in category 1, 2 and 3 and/or lots > ½ acre
• Monitor OSS Operation and Maintenance inspection (Marine Recovery Area model)
• Monitor Farm Plan implementation
• Enhance outreach, education & incentives
• Other????
Next Steps to Develop Strategy

- Refine loading study
- Identify other near term options
- Evaluate potential benefits of actions
- Work with community via Groundwater Protection Committee to define preferred strategies
- Identify major elements by June 2011
Follow on QMH N Study Website

- Documents – QAPP, Preliminary N Load
- Monitoring – Links to collected data
- Project partners – Links to agencies
- Public Participation – Involvement sign-up
- www.kingcounty.gov/qmhnitrogenstudy
Questions?