CITY OF
BAINBRIDGE ISLAND

ISLAND CENTER SUBAREA PLANNING
STEERING COMMITTEE
WEDNESDAY, MARCH 4, 2020
6:30-9:00 PM
COUNCIL CHAMBER
280 MADISON AVE N
BAINBRIDGE ISLAND, WA 98110

AGENDA

6:30 PM	Call to Order, Agenda Review, Conflict Disclosure
6:35 PM	Review and Approve Minutes January 29, 2020
6:45 PM	Debrief from February 10 Open House & Workshop
7:15 PM	Next Steps: Transportation Analysis (see TSI memo) Update to 2015 Sewer Plan Information for Island Center
8:15 PM	Discuss Outline/Structure of Draft Subarea Plan
8:30 PM	Recap of Decisions and Consensus
8:40 PM	Next Meeting: April 1
8:45 PM	Public Comment
9:00 PM	Adjourn

****TIMES ARE ESTIMATES****

Public comment time at meeting may be limited to allow time for Steering Committee deliberation. To provide additional comment to the City outside of this meeting, e-mail us at pcd@bainbridgewa.gov or write us at Planning and Community Development, 280 Madison Avenue, Bainbridge Island, WA 98110

For special accommodations, please contact Jane Rasely, Planning & Community Development 206-780-3750 or at pcd@bainbridgewa.gov

ISLAND CENTER SUBAREA PLANNING STEERING COMMITTEE SPECIAL MEETING MINUTES WEDNESDAY, JANUARY 29, 2020

CITY OF BAINBRIDGE ISLAND

CALL TO ORDER, AGENDA REVIEW, CONFLICT DISCLOSURE
REVIEW AND APPROVE MINUTES – December 4, 2019 and January 22, 2020
REVIEW DRAFT ALTERNATIVES
DISCUSS FORMAT OF FEBRUARY 10,2020 PUBLIC MEETING
RECAP OF DECISIONS AND CONSENSUS
PUBLIC COMMENT
ADJOURN

CALL TO ORDER, AGENDA REVIEW, CONFLICT DISCLOSURE
Chair Maradel Gale called the meeting to order at 6:30 PM. Steering Committee Members in attendance were Vice-chair Micah Strom, Asaph Glosser, Sam Marshall, Michael Loverich, John Decker, Mark Tiernan, Donna Harui, Scott Anderson, Michael Pollock (City Council), Jon Quitslund (Planning Commission) and Jane Rein (Design Review Board). City Staff present were Engineering Manager Mike Michael, Senior Planner Jennifer Sutton and Administrative Specialist Jane Rasely who monitored recording and prepared minutes. City Consultants Jeff Arango (Framework) and Charlie Wenzlau (Wenzlau Architects) were also present.

The agenda was reviewed. The financial interest disclosure was read and each committee member disclosed their financial interest in the Island Center area.

City Councilmember Michael Pollock introduced himself and reiterated that staff and other committee members were here as a resource to the Steering Committee.

REVIEW AND APPROVE MINUTES – December 4, 2019 and January 22, 2020
December 4, 2019 minutes.

Motion: I'll make a motion to approve.
Tiernan/Harui: Passed Unanimously

January 22, 2020 minutes.

Motion: I'll motion to approve.
Marshall/Strom: Passed Unanimously

PUBLIC COMMENT
Heather Burger, Friends of the Farms – Spoke in favor of recognizing and continuing agricultural uses in the Island Center plan. She also asked for incentives for designating a property as agricultural resource land.

DRAFT

Joe Mitchell – Spoke about high density development being incompatible with climate change goals which are a top priority for City Council in 2020.

Emily Grice – Was part of the 2002 Island Center Subarea Planning Process and wanted to know if that document still existed and if the committee had seen it (yes they have).

Patti Dusbabek – Spoke about farmland and woodlands designation protections at the State level as well as being aware of properties that are "under water" during the winter when considering development.

Lisa Macchio – Spoke (as a citizen) about her vision for growth on Bainbridge Island and asked for the focus to be on what would happen holistically on Bainbridge and not a piecemeal fashion.

Mark West – Spoke about considering climate change when considering alternatives.

Katherine Purves – Stated she felt like consultants were looking for a way to put affordable housing on Bainbridge Island and wanted to know if this was being driven by developers.

REVIEW DRAFT ALTERNATIVES

Mr. Jeff Arango from Framework presented the changes made to the three alternatives from the last meeting.

It was decided that the topics that remain the same for each zoning alternative should be introduced first at the public meeting, i.e., critical areas, non-motorized transportation before zoning alternatives.

A sub-committee was formed to work with Mr. Arango on the details of the presentation materials: Mark Tiernan, John Decker, Michael Loverich and Sam Marshall.

DISCUSS FORMAT OF FEBRUARY 10, 2020 PUBLIC MEETING

An open house format with stations of "options" staffed by committee members as an entry point was discussed. Mr. Glosser asked Mr. Loverich to begin the presentation portion of the meeting to establish the voice of the committee. Live polling was discussed as well as other ways to allow people to give their opinion of the options that would be presented. Having BKAT record the meeting for live (preferable) or delayed viewing was discussed.

RECAP OF DECISIONS AND CONSENSUS

- The newly formed sub-committee will meet with Mr. Arango before the public meeting.
- The meeting will begin with an open house format including stations staffed by committee members, staff, consultants and liaisons.
- Michael Loverich will begin the presentation with a history of the Island Center area.
- Jeff Arango will present the alternatives and facilitate polling.
- Q&A will occur after the presentation.
- Staff will reach out to BKAT about recording.
- There will be opportunity for citizens who could not make it to the meeting to fill out materials online (polling).

PUBLIC COMMENT

Doug Raugh – Spoke about the word “improvement” stating they should not use it without defining it first. He also wanted them to explain why they were making certain changes so the public would not know what they were gaining as opposed to what they were giving up.

Jim Halbrook – Wanted to understand what was driving the process.

Ron Peltier – Spoke about having information regarding sewer within their draft plan.

Lisa Neal – Had two questions: Who exactly was going to be on the sub-committee and had notices already gone out because she had not received one yet.

Bob Russell – Wanted to see alternate four and thought it was really important to see the information the committee had asked for in their last meeting and was disappointed it had not been presented at this meeting. He also asked about the amount of parking that would be left on the City owned parcel because Congregation Kol Shalom used about 40-45% of it when they met.

Chris Neal – Was concerned about the misuse of terms from the Growth Management Act and/or the Comprehensive Plan.

Tami Meeker – Asked if online polling were used would it be possible for someone to vote multiple times (only one vote per IP address allowed).

ADJOURN

Meeting adjourned at 8:49 PM.

DRAFT

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Technical Memorandum

February 28, 2020

TO: Jeff Arango, AICP
FRAMEWORK

FROM: Andrew Bratlien, PE

SUBJECT: Island Center Subarea Existing Conditions Summary

This memorandum summarizes the existing transportation conditions of the Island Center Subarea.

STUDY AREA

Island Center is one of four designated Neighborhood Centers identified by the Bainbridge Island Comprehensive Plan. Neighborhood Centers are identified by the Comprehensive Plan as places which can offer housing and small-scale commercial and service activity outside of the Winslow area. As a Neighborhood Center, Island Center is expected to reduce traffic congestion by providing commercial development as an alternative to traveling to Winslow. The Comprehensive Plan also encourages pedestrian-oriented development in Neighborhood Centers.

The boundaries of the Island Center Special Planning area and the larger Island Center Study area are shown in **Figure 1**.

EXISTING ROADWAY NETWORK

Functional Classification Definition

Functional classification is defined by the Federal Highway Administration (FHWA) *Highway Functional Classification Concepts, Criteria and Procedures* as "the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide." Functional classification provides a conceptual framework for identifying the role of individual streets in serving the two primary goals of a roadway network: (1) access to/from specific locations, and (2) travel mobility. Qualitative descriptions of the functional classifications in Bainbridge Island are described in **Table 1**.

Figure 1. Island Center Subarea Planning Boundaries

In general, functional classification indicates a position on a spectrum between access and mobility, as shown in **Figure 2**. For example, arterials emphasize travel mobility at the expense of land access, while local streets provide land access with less emphasis on mobility.

Functional classification also carries expectations about roadway design, including speed, capacity, and roadway width. **Table 2** summarizes the relationship between functional classification and key travel characteristics.

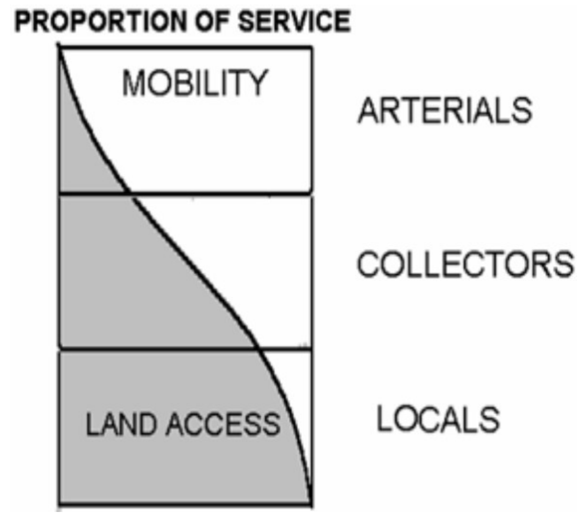


Figure 2. Functional Classification Roles
Source: *Functional Classification Comprehensive Guide* (Virginia DOT 2014)

Table 1. Functional Classification Descriptions

Functional Classification	Description
Principal Arterial	• Serve highest traffic volume corridors and longest trip demands • Carry high proportion of total urban travel on minimum of mileage • Interconnect major rural corridors to accommodate trips entering and leaving urban area and trips through an urban area
Minor/ Secondary Arterial	• Serve trips of moderate length • Distribute traffic to smaller geographic areas than those served by Principal Arterials • Provide more land access than Principal Arterials without penetrating neighborhoods • Provide connectivity between Principal Arterials and Collectors
Collector	• Provide land access and mobility in higher density residential and commercial/industrial areas • Penetrate residential neighborhoods, often for significant distances • Distribute trips between Local Roads and Arterials, usually over a distance greater than ¾ mile • Operate with higher speeds and more signalized intersections than Arterials
Local Roads	• Provide direct access to adjacent property; • Provide access to higher systems • Carry limited or no through traffic • Typically serve short trips

Source: *Guidelines for Amending Functional Classification in Washington State* (WSDOT 2013)

Table 2. Relationship between Functional Classification and Travel Characteristics

Functional Classification	Distance Served / Length of Route	Access Points	Speed Limit	Distance Between Routes	Usage (AADT and DVMT)	Significance	Number of Travel Lanes
Principal Arterial	Longest	Least	Highest	Longest	Highest	Statewide/ Regional	Most
Minor Arterial	Long	Few	High	Long	High	Subregional/ Citywide	More
Major Collector	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Local Access	Short	Many	Lowest	Shortest	Lowest	Local	Fewest

Source: *Highway Functional Classification Concepts, Criteria and Procedures* (FHWA 2013)

Existing Functional Classification

The transportation network in the Island Center subarea, shown in **Figure 3**, consists of the following functionally classified roadways:

Miller Rd is a north-south secondary arterial which begins at New Brooklyn Rd and terminates at Day Rd just west of SR 305. The street functions as an important corridor for commute, retail, and freight travel. In the subarea, Miller Rd consists of two 10-foot travel lanes with 0 to 3-foot paved shoulders. Miller Rd includes a short section of non-ADA-compliant concrete sidewalk on the east side just north of New Brooklyn Rd.

Fletcher Bay Rd is a north-south secondary arterial to the south of New Brooklyn Rd. It provides access to Lynwood Center Rd and Bucklin Hill Rd to the south. The road consists of two 10-foot travel lanes with 0 to 3-foot paved shoulders. Fletcher Bay Rd continues to the west of the New Brooklyn Rd intersection as a collector street, providing access to the Fletcher Bay area.

High School Rd is an east-west secondary arterial which connects Fletcher Bay Rd with SR 305 to the east. It provides direct access to Bainbridge High School and commercial development to the east of Island Center. The route functions as an important commute, retail, school, and freight corridor. High School Rd consists of two 10-foot travel lanes with 2-foot paved shoulders in the study area.

New Brooklyn Rd is an east-west collector which connects Miller Rd and Fletcher Bay Rd with SR 305 (via Madison Ave) to the east. It functions as a school corridor, providing indirect access to Woodward Middle School and Ordway Elementary School to the east. New Brooklyn Rd consists of two 10-foot travel lanes with 2-foot paved shoulders in the study area.

Arrow Point Dr, **Tolo Rd**, and **Battle Point Dr** are two-lane collectors which provide access to local streets and properties in the Battle Point area.

Springridge Rd, **Hansen Rd**, **Foster Rd**, and **Fletcher Bay Rd** are two-lane collector streets which serve the Fletcher Bay area, providing access to local streets in addition to providing direct property access.

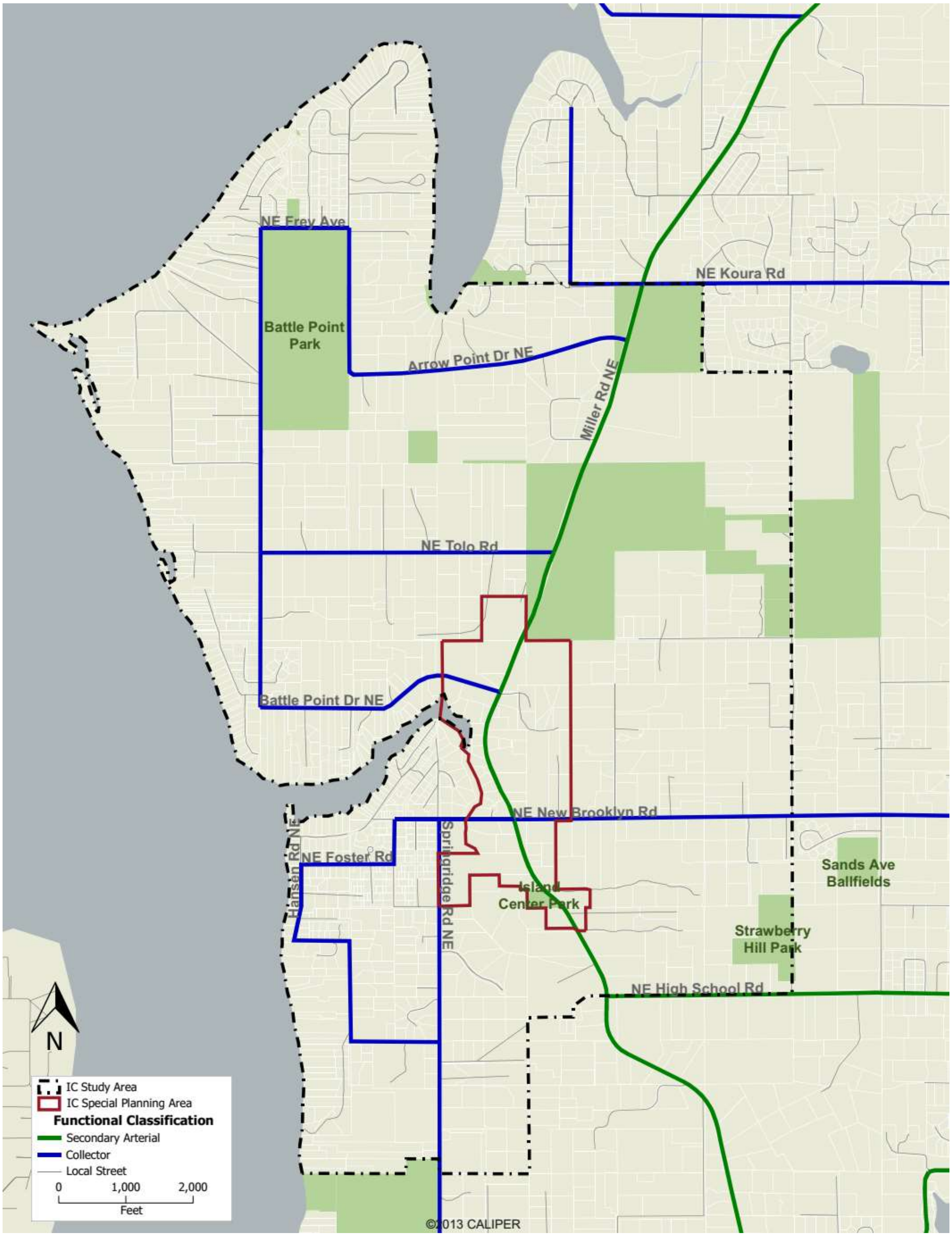


Figure 3. Island Center Subarea Functional Classification

DATA COLLECTION

Peak Hour Traffic Volumes

Bainbridge Island staff provided traffic counts collected at the following four study area intersections from 7-9 AM and from 4-6 PM on Thursday, December 5, 2019:

- Miller Rd & Arrow Point Dr
- Miller Rd & Tolo Rd
- Miller Rd & New Brooklyn Rd
- Fletcher Bay Rd & High School Rd

Traffic count data was reviewed to identify the highest four consecutive 15-minute volume intervals in the AM and PM peak periods. These AM and PM peak hour volumes, summarized in **Table 3,** were applied to the intersection Level of Service analysis described later in this memorandum.

Table 3. 2019 Peak Hour Turning Movement Volumes

Period	Northbound			Southbound			Eastbound			Westbound		
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Miller Rd & Arrow Point Dr												
AM Peak	61	182			402	54	51		71			
PM Peak	34	379			232	31	51		38			
Miller Rd & Tolo Rd												
AM Peak	10	233			456	14	14		23			
PM Peak	18	383			250	17	14		22			
Miller Rd/Fletcher Bay Rd & New Brooklyn Rd												
AM Peak	22	193	15	148	373	16	35	47	42	6	21	72
PM Peak	35	267	11	93	218	33	24	25	28	6	28	147
Fletcher Bay Rd & High School Rd												
AM Peak	2	148	38	219	208	0	0	1	2	22	0	88
PM Peak	1	159	18	128	124	1	0	1	0	40	1	177

Average Daily Traffic Volumes and Speeds

Staff also provided seven-day Average Daily Traffic (ADT) volume and speed data collected in November and December 2019 on several segments in the study area. Daily traffic volumes and 85th percentile observed speeds are summarized in **Table 4**.

Seven-day ADT counts were compared to data collected at the same locations in 2012. Volume trends indicate an average growth rate of approximately 2 percent per year along the Miller Rd/Fletcher Rd corridor. New Brooklyn Rd grew by 3.1 percent per year while High School Rd to the south decreased by 1.1 percent per year.

The collectors Arrow Point Dr, Tolo Rd, and Battle Point Dr grew by a combined average of 2.8 percent per year from 2012 through 2019.

Table 4. 2019 Average Daily Traffic Volume and 85th Percentile Speed

Street Name	Location	Functional Classification	7-Day ADT[1]		Speed (mph)	
			2012	2019	Posted	85th %ile[2]
Miller Rd	s/o Koura Rd	Secondary Arterial	4,810	5,800 (+2.9%/yr)	35	38 (+3)
Miller Rd	n/o New Brooklyn Rd	Secondary Arterial	5,760	6,700 (+2.3%/yr)	35	34 (-1)
Fletcher Bay Rd	s/o New Brooklyn Rd	Secondary Arterial	5,090	5,480 (+1.1%/yr)	35	32 (-3)
Fletcher Bay Rd	s/o High School Rd	Secondary Arterial	3,100	3,600 (+2.3%/yr)	35	45 (+10)
High School Rd	e/o Fletcher Bay Rd	Secondary Arterial	3,720	3,430 (-1.1%/yr)	35	42 (+7)
New Brooklyn Rd	e/o Miller Rd	Secondary Arterial	2,080	2,530 (+3.1%/yr)	35	42 (+7)
Arrow Point Dr	w/o Miller Rd	Collector	1,350	1,690 (+3.7%/yr)	35	38 (+3)
Tolo Rd	w/o Miller Rd	Collector	450	750 (+9.7%/yr)	30	41 (+11)
Battle Point Dr	w/o Miller Rd	Collector	1,290	1,240 (-0.6%/yr)	25	32 (+7)
Fletcher Bay Rd	w/o Miller Rd	Collector	2,100	1,940 (-1.1%/yr)	25	41 (+16)

[1]Average Daily Traffic volume based on seven-day traffic count; [2]85th percentile speed and speed differential vs. posted speed

The following roadway segments indicated 85th percentile speeds which exceed the posted speed by more than 5 mph. These may be candidates for design improvements (e.g. traffic calming), increased enforcement, driver education, or modified speed limits:

- Fletcher Bay Rd south of High School Rd (+10 mph over posted speed)
- High School Rd east of Fletcher Bay Rd (+7 mph)
- New Brooklyn Rd east of Miller Rd (+7 mph)
- Tolo Rd west of Miller Rd (+11 mph)
- Battle Point Dr west of Miller Rd (+7 mph)
- Fletcher Bay Rd west of Miller Rd (+16 mph)

<u>Roadway Characteristics</u>

Transportation Solutions reviewed Google Earth Pro and Bing Maps satellite and street-level photography to determine existing roadway characteristics including roadway geometry, channelization, intersection control, turn restrictions, and posted speeds.

<u>Crash History</u>

Washington State Department of Transportation (WSDOT) provided crash data for the five-year period from November 1, 2014 through October 31, 2019. Crash trends are summarized later in this document.

CRASH ANALYSIS

A total of 921 crashes occurred in Bainbridge Island from November 1, 2014 through October 31, 2019. The Island Center Subarea accounted for 46 crashes during the same period. Crashes are shown graphically in **Figure 4**.

Crashes within the subarea are predominantly property-damage-only (PDO) crashes. One serious injury crash occurred on Friday, October 19, 2018 at the intersection of High School Rd and Fletcher Bay Rd when a westbound left-turning vehicle failed to observe a stop sign and left the roadway. Alcohol was cited as a contributing factor.

Fixed object collisions are the predominant crash type in the study area, representing 43 percent of crashes. This trend is not uncommon for rural roadway segments with narrow shoulders. The next most common crash type is entering at angle, representing 24 percent of crashes in the study area.

Crash rates were calculated for the Miller Rd/Fletcher Bay Rd corridor, as indicated in **Table 5**. Roadway segment crash rates are typically expressed in terms of crashes per 100 million vehicle-miles traveled (VMT) and are calculated as shown below:

$$R = \frac{C\ x\ 100{,}000{,}000}{V\ x\ 365x\ N\ x\ L}$$

where:

$R =$ Crash rate expressed as crashes per 100 million vehicle-miles of travel,
$C =$ Total number of crashes in the study period,
$V =$ Average daily traffic (ADT) volume,
$N =$ Number of years of crash data, and
$L =$ Length of roadway segment in miles

Table 5. Miller Rd/Fletcher Bay Rd Corridor Crash Rates

Segment	Length (mi)	ADT[1] (veh/day)	5-Year Crashes[2]	Crash Rate[3] (/100M VMT)
Koura Rd to Tolo Rd	0.80	6,520	10	118.1
Tolo Rd to New Brooklyn Rd	0.80	7,480	9	92.0
New Brooklyn Rd to HS Rd	0.57	6,190	11	193.0
			Kitsap County Average[4]	175.4
			Washington State Average[4]	196.2

[1]Average daily traffic volume, per 2019 counts; [2]Total crashes, 11/1/2014-10/31/2019; [3]Crashes per 100 million vehicle miles traveled; [4]Source: 2015 Annual Collision Summary (WSDOT)

The segment of Fletcher Rd from New Brooklyn Rd to High School Rd exhibits the highest crash rate within the study area, at 193.0 crashes per 100M VMT. This is higher than the Kitsap County average of 175.4 crashes per 100M VMT and slightly lower than the statewide average of 196.2 crashes per 100M VMT, as identified in the WSDOT *2015 Annual Collision Summary*.

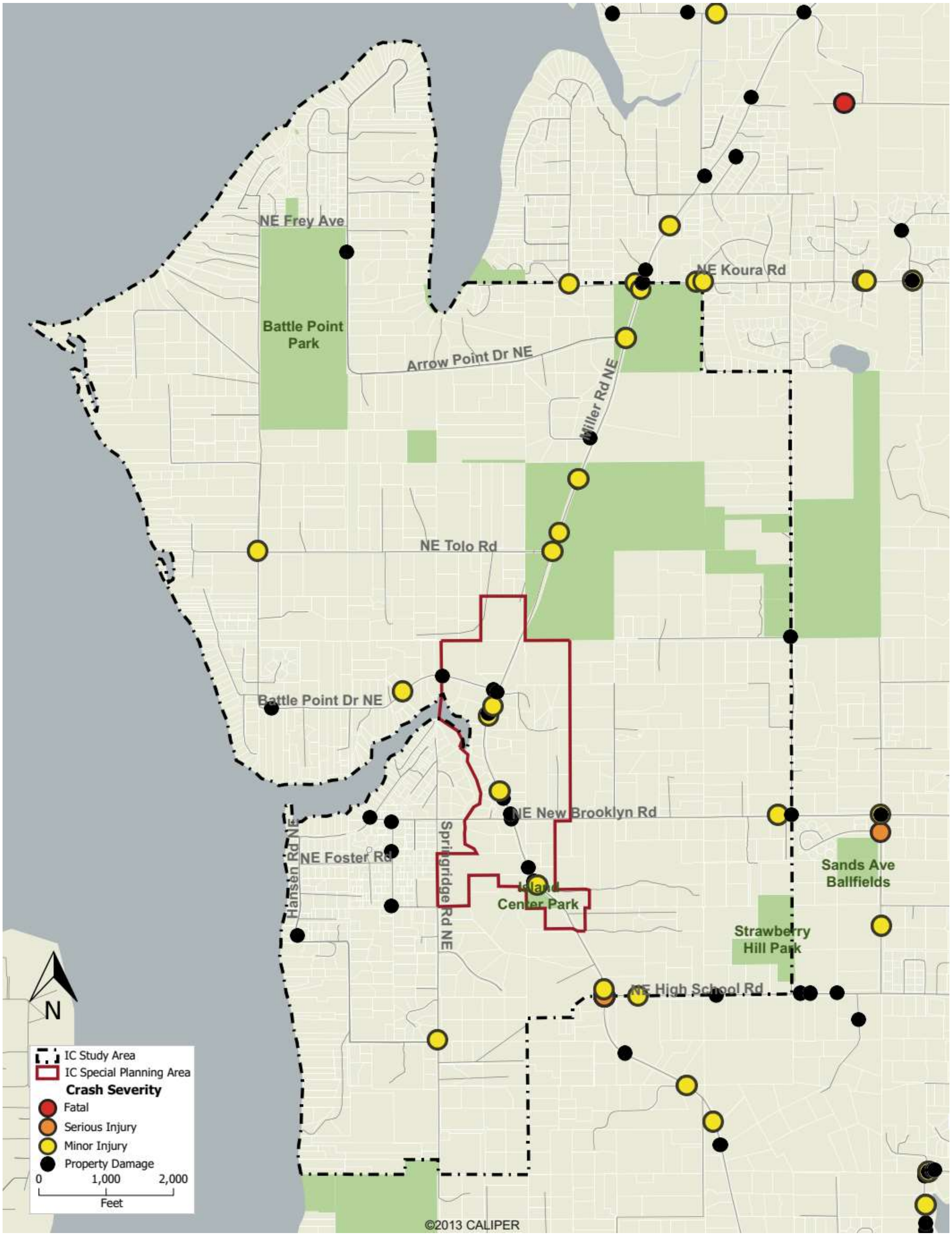


Figure 4. Crash History, 11/1/2014 – 10/31/2019

MULTIMODAL TRANSPORATION

<u>Transit Service</u>

Fixed-route transit service in the Island Center area is currently provided via Kitsap Transit Routes 95 and 106. Most bus stops in the study area are not marked with Kitsap Transit signs.

Route 95 provides weekday commuter service between Battle Point and the Bainbridge Island Ferry Terminal, as shown in the route map in **Figure 5**. The route includes stops at the following intersections in the study area:

- Miller Rd & Tolo Rd
- Frey Ave & Battle Point Dr
- Miller Rd & New Brooklyn Rd

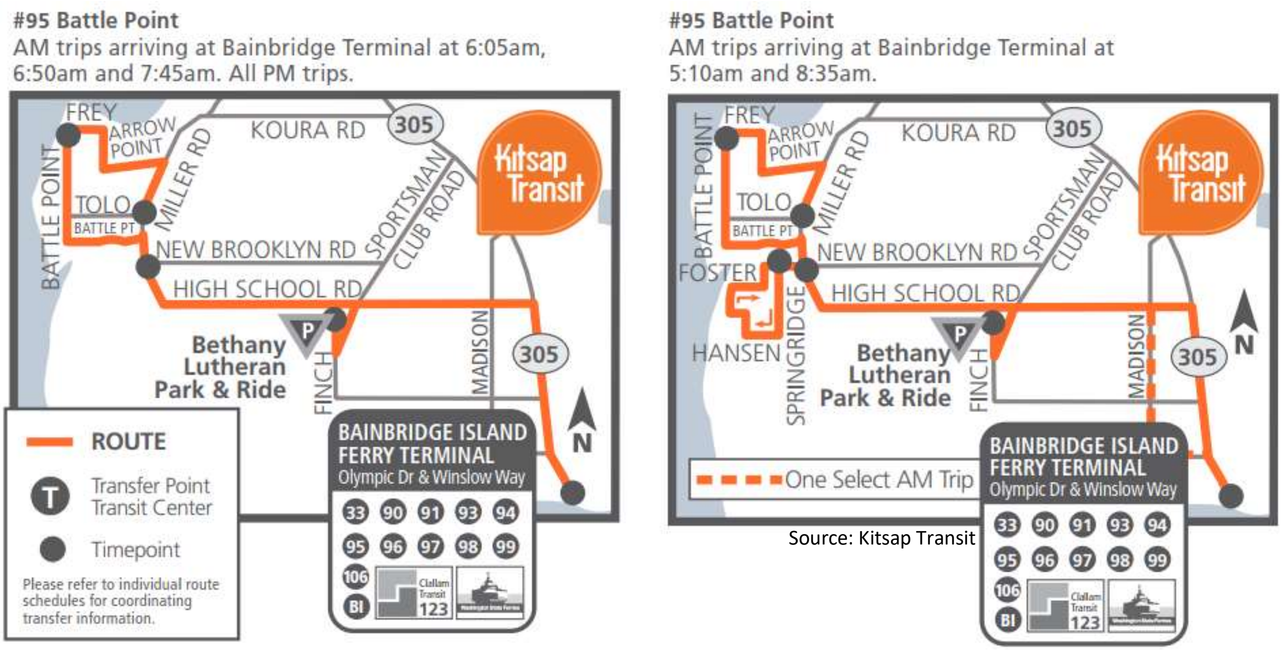
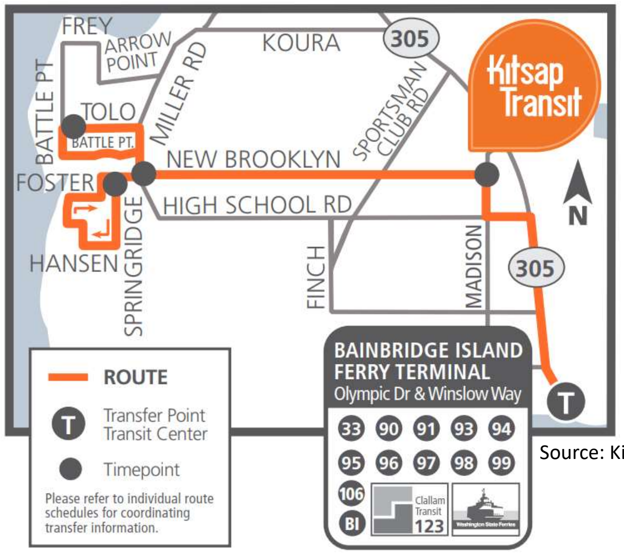


Figure 5. Kitsap Transit Route 95 Map

Route 106 provides weekday commuter service between Fletcher Bay and the Bainbridge Island Ferry Terminal, as shown in the route map in **Figure 6**. The route includes stops at the following intersections in the study area:

- Tolo Rd & Battle Point Dr
- Springridge Rd & Fletcher Bay Rd
- Miller Rd & New Brooklyn Rd

In addition to the fixed-route service described above, dial-a-ride service is provided via Kitsap Transit's ACCESS and BI Ride programs.



Source: Kitsap Transit

Figure 6. Kitsap Transit Route 106 Map

<u>Nonmotorized Transportation</u>

The Island Center Subarea includes several parks and open spaces which are connected by a series of Bainbridge Island Municpal Parks and Recreation District (BIMPRD) trails, as shown in **Figure 7**. Roadways within the subarea generally consist of two paved travel lanes with limited or no paved shoulder. Sidewalks exist on three quadrants of the Miller Rd/Fletcher Bay Rd and New Brooklyn Rd intersection but curb ramps do not appear to be ADA-compliant.

LEVEL OF SERVICE

<u>Level of Service Definition</u>

Level of service (LOS) is a qualitative description of the operating performance of an element of transportation infrastructure such as a roadway or an intersection. LOS is typically expressed as a letter score from LOS A, representing free flow conditions with minimal delays, to LOS F, representing breakdown flow with high delays.

Intersection Level of Service

Intersection LOS is based on the average delay experienced by a vehicle traveling through an intersection. Delay at a signalized intersection can be caused by waiting for the signal or waiting for the queue ahead to clear the signal. Delay at roundabouts and stop-controlled intersections is caused by waiting for a gap in traffic or waiting for a queue to clear the intersection or roundabout.

Delay for signalized and stop-controlled intersections was calculated in Synchro 9 software using Highway Capacity Manual 2010 (HCM2010) methodology. Roundabout delay was calculated in Sidra Intersection 8 software using the Sidra capacity model and signalized level of service thresholds, per WSDOT October 2019 Sidra policy guidelines.

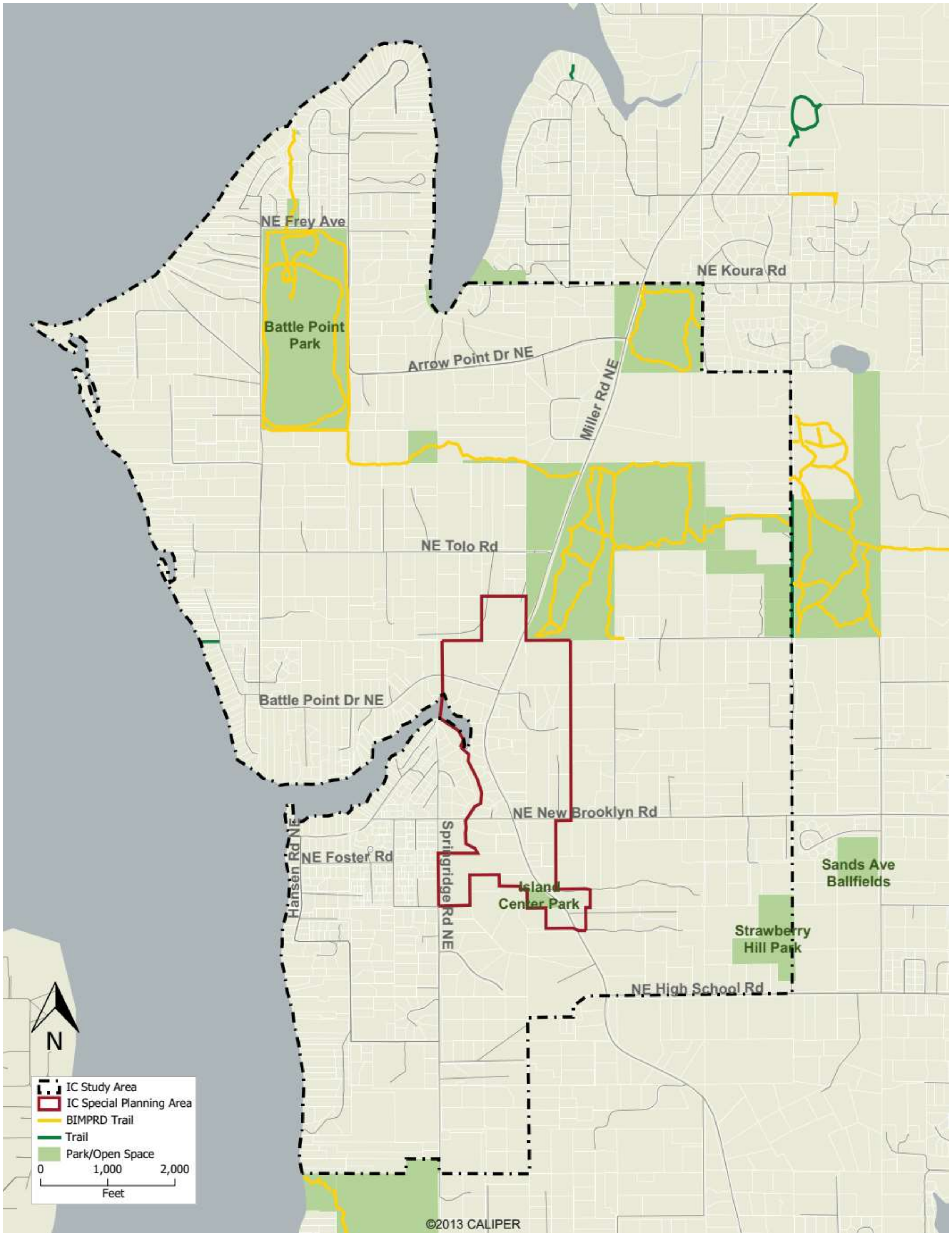


Figure 7. Island Center Parks and Trails

Delay is defined differently for signalized and all-way stop controlled intersections than for two-way stop controlled (i.e. stop control on minor approach) intersections. For signalized and all-way stop controlled intersections, level of service thresholds are based upon average control delay for all vehicles (on all approach legs) entering the intersection. For minor-approach-only stop controlled intersections, delay is reported for the movement with the worst (highest) delay. **Table 6** shows the amount of delay used to determine LOS for signalized and unsignalized intersections.

Segment Level of Service

Segment LOS is measured by the relationship between traffic volume (V) and capacity (C) of a roadway. As the volume of traffic using the roadway approaches the capacity of the roadway (V/C approaches 1.0), the LOS deteriorates. **Table 6** indicates adopted LOS thresholds for street segments in Bainbridge Island.

Table 6. Level of Service Thresholds

LOS	Signalized and Roundabout Delay (sec/veh)	Unsignalized Delay (sec/veh)	Street Segment Volume/Capacity (V/C) Ratio
A	≤10	≤10	< 0.60
B	>10 – 20	>10 – 15	0.60 – 0.69
C	>20 – 35	>15 – 25	0.70 – 0.79
D	>35 – 55	>25 – 35	0.80 – 0.89
E	>55 – 80	>35 – 50	0.90 – 1.00
F	>80	>50	> 1.00

Segment capacity was calculated consistent with the peak-hour based segment capacity methodology used in the 2017 Island-Wide Transportation Plan.

Level of Service Policy

Bainbridge Island Level of Service has defined the following minimum Level of Service standards for Neighborhood Centers, including the Island Center Subarea:

- LOS D for Secondary Arterials
- LOS C for Collectors and local streets

2019 Intersection LOS

Intersection LOS was analyzed for the AM and PM peak hours of travel and is summarized in **Table 7**. The December 2019 traffic counts indicated AM peak hour demand 6 to 12 percent higher than PM peak hour demand at the four study intersections.

Table 7. 2019 Intersection Levels of Service

ID	Location	Control Type	AM Peak Hr		PM Peak Hr	
			Volume, vph	LOS (Delay)	Volume, vph	LOS (Delay)
1	Miller Rd & Arrow Point Dr	TWSC	821	C (17.3)	765	C (16.9)
2	Miller Rd & Tolo Rd	TWSC	750	B (13.6)	704	B (12.8)
3	Miller Rd & New Brooklyn Rd	AWSC	990	C (20.5)	915	B (12.7)
4	Fletcher Bay Rd & High School Rd	TWSC	728	B (13.1)	650	B (14.5)

[1]TWSC = minor approach stop control; AWSC = all-way stop control; [2]For TWSC intersections, delay is reported for the worst (i.e. highest-delay) movement; for all other control types, average intersection delay is reported

All intersections operate at LOS C or better in both peak hours. No intersection LOS deficiencies exist in the study area.

2019 Street Segment LOS

Street segment LOS was evaluated for each segment based on 2019 AM and PM peak hour volumes and capacity thresholds consistent with the Island-Wide Transportation Plan. Results are summarized in **Table 8**. No street segments currently operate below minimum LOS standards.

Table 8. 2019 Street Segment Levels of Service

Street Name	Location	Capacity	Volume		V/C		LOS	
			AM	PM	AM	PM	AM	PM
Miller Rd	s/o Koura Rd	940	689	693	0.73	0.74	C	C
Miller Rd	n/o New Brooklyn Rd	940	837	782	0.89	0.83	D	D
Fletcher Bay Rd	s/o New Brooklyn Rd	940	651	565	0.69	0.60	B	B
Fletcher Bay Rd	s/o High School Rd	940	420	342	0.45	0.36	A	A
High School Rd	e/o Fletcher Bay Rd	940	367	365	0.39	0.39	A	A
New Brooklyn Rd	e/o Miller Rd	800	309	310	0.39	0.39	A	A
Arrow Point Dr	w/o Miller Rd	800	237	154	0.30	0.19	A	A
Tolo Rd	w/o Miller Rd	800	61	71	0.08	0.09	A	A
Fletcher Bay Rd	w/o Miller Rd	800	183	173	0.23	0.22	A	A

FINDINGS

The findings of this existing conditions analysis are summarized below.

- Traffic volumes on the Miller Rd/Fletcher Bay Rd corridor increased by approximately 2 percent per year between 2012 and 2019.
- 85th percentile speeds exceed posted speeds on several secondary arterial and collector streets in the study area.
- The crash rate on Miller Rd from New Brooklyn Rd to High School Rd exceeds the Kitsap County average.
- Nonmotorized facilities in the study area include an off-street trail network but limited on-street facilities.
- No intersections or street segments currently operate below minimum LOS standards. However, future local and regional travel demand growth may trigger LOS deficiencies.

Appendix G

PROJECT MEMORANDUM 1 – MID-ISLAND TREATMENT OPTIONS

Carollo
Engineers...Working Wonders With Water®

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Seattle, Washington 98101
P. 206.684.6532
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PROJECT MEMORANDUM

Project Name:	General Sewer Plan	**Date:**	8/25/2014
Client:	City of Bainbridge Island	**Project Number:**	9162A.00
Prepared By:	Alena Bennett		
Reviewed By:	Karl Hadler, Lara Kammereck		
Subject:	Mid-Island Study Area Sewer Service Options – Draft		
Distribution:	Chris Munter		

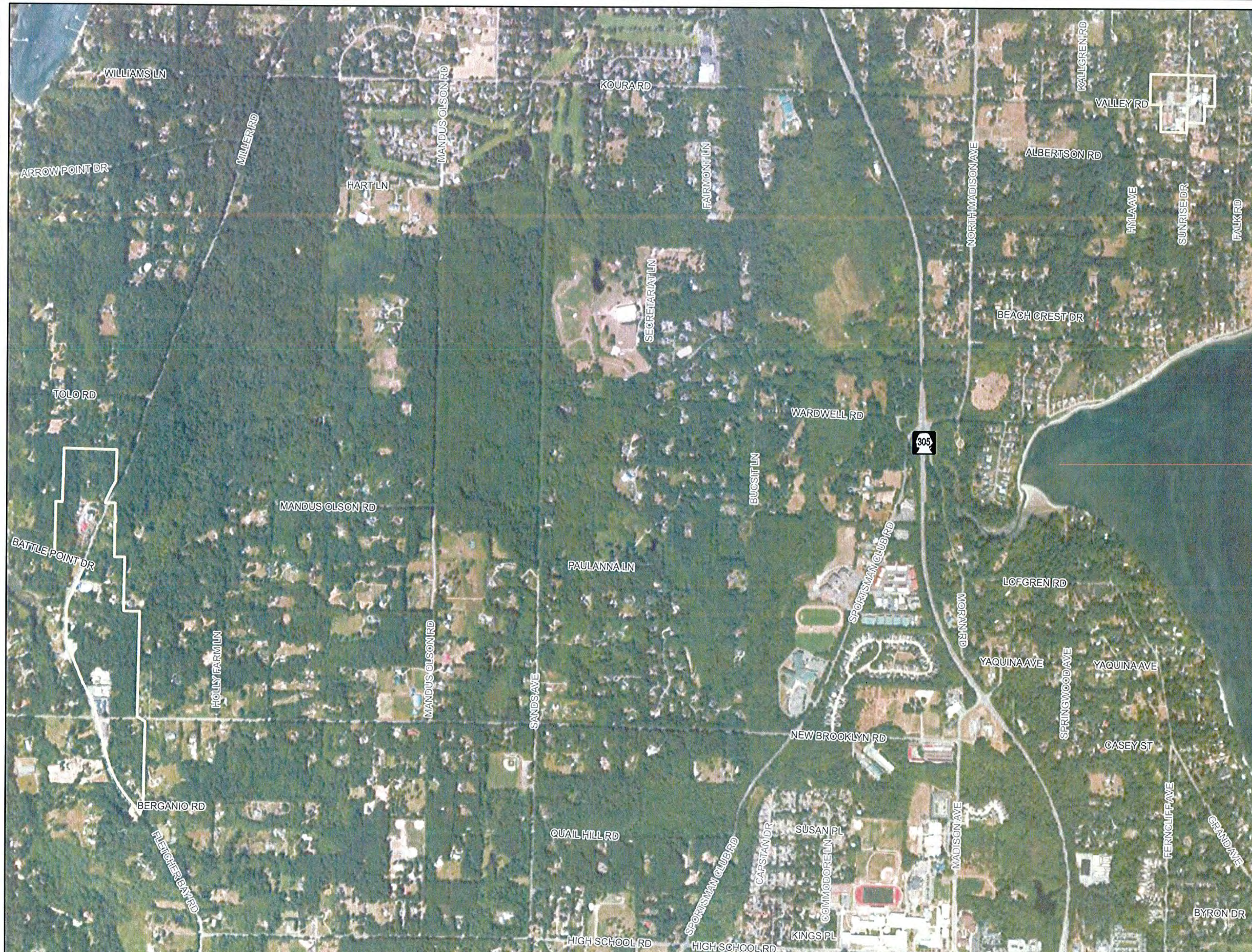
1.0 PURPOSE AND BACKGROUND

The City of Bainbridge Island (City) has identified two neighborhood service centers outside of Winslow for potential future City sewer service. These two areas were delineated as the Mid-Island Study Area. The boundaries of the Mid-Island Study Area are shown in Figure 1. The western pocket is located near the intersection of Miller Road and New Brooklyn Road. The eastern pocket is centered at the intersections of Valley Road and Sunrise Drive.

The purpose of this project memorandum is to provide an overview of the sewer treatment and disposal options available for the Mid-Island Study Area as permitted by local and state regulations.

2.0 MID-ISLAND FLOW PROJECTIONS

Build-out average dry weather flow (ADWF) projections for the eastern and western pockets were estimated using land use data and the wastewater flow factors developed for the Winslow Collection System based on data from the flow monitoring program that was carried out from November 2013 through February 2014. A peaking factor between ADWF and peak hour flow (PHF) of three (3) was assumed to estimate peak hour flows, which is based on the Washington State Department of Ecology (Ecology) design guideline for sewers and pump stations. As shown in Table 2.1, ADWFs of 2,570 gpd and 13,020 gpd are projected for the eastern and western pockets, respectively. This corresponds to peak flows of 7,710 gpd and 39,060 gpd for the eastern and western pockets, respectively.



Legend

Mid Island Study Area

N

0 1,250 2,500 Feet

Figure 1
Mid-Island Study Area
General Sewer Plan
City of Bainbridge Island

City of Bainbridge Island

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Source: Kitsap County

Table 2.1 Mid-Island Study Area Build-out Flows
General Sewer Plan
City of Bainbridge Island

Land Use Classification	Acreage	Flow Factor (gpd/ac)	Flow (gpd)
Eastern Pocket			
Commercial	8.6	300	2,570
Roads, etc.	1.9	0	0
Total ADWF			2,570
Total PHF(1)			7,710
Western Pocket			
Commercial	13.7	300	4,110
Low-density Residential	42.9	200	8,580
Public	4.7	70	330
Roads, etc.	2.1	0	0
Total ADWF			13,020
Total PHF(1)			39,060

Notes:
1. Peaking factor of 3.

3.0 ON-SITE TREATMENT VS. CONVEYANCE TO WINSLOW COLLECTION SYSTEM

The City has two basic options for treating the wastewater flows of the eastern and western pockets: individual on-site treatment systems for each pocket, or conveyance of wastewater flows from each pocket to the Winslow Collection System where it can be treated at the Winslow Wastewater Treatment Plant (WWTP). The eastern and western pockets are situated far enough apart such that separate treatment systems would need to be constructed for each pocket. Also, in the case of conveyance to the Winslow Collection System, separate pump stations and force mains would be constructed for each pocket.

The force mains from each pocket would have an approximate length of 11,500 ft. The western pocket would likely connect to the Winslow Collection System near Woodward School and the eastern pocket could connect at the North Town Pump Station. The amount of flow contributed by the Mid-Island pockets would account for about two percent of the 0.72-mgd ADWF projected for 2035 for the Winslow Collection System.

The conveyance to the Winslow Collection System option is considered in more detail in Section 8.0, Option Comparison. Sections 4.0 through 7.0 describe the various on-site treatment options and considerations.

4.0 ON-SITE SYSTEM REGULATIONS

The Mid-Island Study Area sewage can either be conveyed to an existing wastewater treatment facility, or new on-site treatment systems can be constructed. Large on-site sewage systems (LOSS) treating peak flows of 3,500 to 100,000 gpd are regulated by the Washington State Department of Health (DOH) under 246-272B WAC. Local health jurisdictions retain regulatory authority for systems designed to treat less than 3,500 gpd. Sewage treatment systems larger than 100,000 gpd in capacity are regulated by the Department of Ecology (Ecology). Ecology also regulates any surface water discharge regardless of flow. The peak flows of the eastern and western Mid-Island pockets place them within DOH's regulatory jurisdiction.

Under 246-272B WAC, DOH defines five levels of treatment; A through E as defined in Table 4.1. A minimum level of treatment is required for each disposal option. The minimum required level of treatment is also dependent on the soil conditions of the disposal site. Soil types are grouped into seven categories as defined in Table 4.2.

Table 4.1 DOH Treatment Levels
General Sewer Plan
City of Bainbridge Island

Level	$CBOD_5$	TSS	FC
A	10 mg/L	10 mg/L	200/100 mL
B	15 mg/L	15 mg/L	1,000/100 mL
C	25 mg/L	30 mg/L	50,000/100 mL
D	25 mg/L	30 mg/L	---
E	125 mg/L	80 mg/L	---

Notes:
1. Table is reprinted from WAC 246-272A-0110 Table III.
2. $CBOD_5$ = five-day carbonaceous biochemical oxygen demand. TSS = total suspended solids. FC = fecal coliform.

Table 4.2 Soil Types and Hydraulic Loading Rates
General Sewer Plan
City of Bainbridge Island

Soil Type	Soil Textural Classification	Maximum Hydraulic Loading rate, for residential strength effluent (gal/sf/day)
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils.	1.0
2	Coarse sands.	1.0
3	Medium sands, loamy coarse sands, loamy medium sands.	0.8
4	Fine sands, loamy fine sands, sandy loams, loams.	0.6
5	Very fine sands, very fine loamy sand, very fine sandy loams; or silt loams and sandy clay loams with a moderate or strong structure (excluding platy structure).	0.4
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.	Not suitable
7	Sandy clay, clay, silty clay, strongly cemented or firm soils, soil with a moderate or strong play structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays. Soils greater than 90% rock.	Not suitable

Notes:
1. Table is reprinted from WAC 246-272B-03400 Table 1.

5.0 DISPOSAL OPTIONS

There are two general options for wastewater disposal: surface water or land. The means of wastewater effluent disposal drives the treatment requirements and dictates regulatory authority. Therefore, in this memorandum disposal options are discussed first in this section, followed by treatment options in the next section.

5.1 Surface Disposal

A surface water disposal system would consist of a new outfall to Puget Sound. This option would be the most challenging disposal option to permit, requiring extensive science and engineering studies for permit approval. Ecology regulates any surface water discharge. The permitting process would require, at a minimum, that the water quality standards for the particular receiving water body be maintained. Water quality samplings, effluents mixing modeling, and scientific studies evaluating disposal impacts are required. In addition to Ecology permitting requirements, other state and federal agencies require permits to establish surface water discharge of wastewater. State Agencies require a Comprehensive Alternatives Analysis

(CAA) to determine if a "reasonable and feasible" alternative for siting a surface water discharge exists.

5.2 Land Disposal

Any land disposal option will require an evaluation of soil and groundwater conditions. Descriptions of the land disposal options follow.

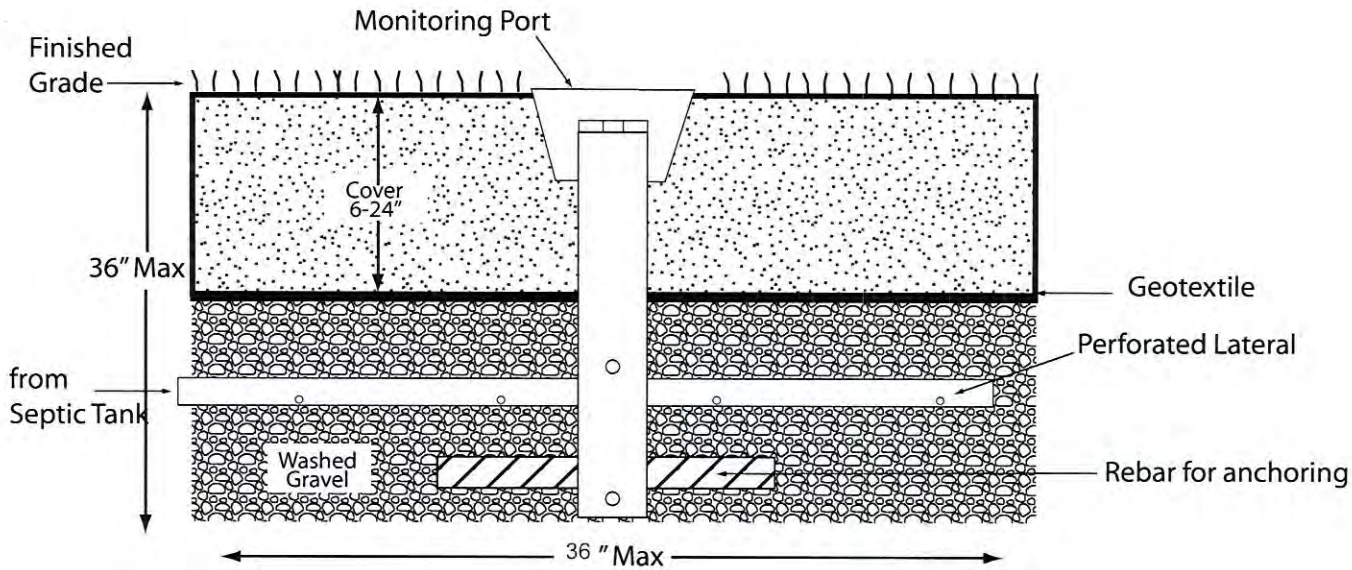
5.2.1 Land Treatment

In a land treatment disposal system, preliminary treated effluent is spray applied to crops for additional treatment in the upper soil root zone. Land treatment is regulated by Ecology. Applied water that does not percolate into the soil or evapotranspire is collected and reapplied to the field. Adsorptive capacity of the field is dependent on rainfall and temperature. Storage basins are typically needed for cold weather or during precipitation.

5.2.2 Drainfield

In a conventional drainfield or "sub-surface soil adsorption system" (SSAS), pretreated effluent flows through a network of underground perforated pipes in trenches or beds and is discharged to original, undisturbed soil. Typically, the pipes are embedded in gravel although other trench media is approved for use ("gravelless drainfield"). A typical cross section is shown in Figure 2. Additional treatment occurs as effluent percolates through the trench bedding and surrounding soil. Drainfields cannot be sited in unstable landforms including areas where slopes are greater than 30 percent. Effluent is distributed throughout the drainfield by a pressure distribution system.

According to WAC 246-272B-06250, wastewater that is not residential strength (i.e. commercial strength) must meet a minimum of treatment level E prior to drainfield disposal. Higher levels of pretreatment may be required depending on soil type, flow, and vertical separation from groundwater or an impervious soil layer.



* Figure from WA DOH Design Standards for Large On-site Sewage Systems December 1993, Amended July 1994.

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Figure 2
Drainfield Land Disposal Conventional Trench Detail
PM 1 - Mid-Island Study Area Sewer Service Options
General Sewer Plan
City of Bainbridge Island

5.2.3 Subsurface Drip System

A subsurface drip system (SDS) is an efficient pressurized wastewater distribution system that can deliver small, precise doses of effluent to shallow subsurface dispersal/reuse fields. SDS distribution piping is small diameter, flexible polyethylene tubing (dripline) with small in-line emitters (orifices that can discharge effluent at slow, controlled rates, usually specified in gallons per hour). Driplines can be trenched (by hand or with a trenching machine) into narrow, shallow trenches or plowed directly into the soil and backfilled without gravel or geotextile. Typical installation depth is between 6 and 10 inches. In addition to the simplified construction methods, another advantage of an SDS is that the land area required is much less than a conventional drainfield. According to a July 2012 DOH publication called Subsurface Drip Systems, pretreatment of commercial wastewater to at least treatment level E is required for SDS systems.

5.2.4 Reclaimed Water Use – Groundwater Disposal

Highly treated wastewater can be applied to land for groundwater recharge by application through percolation ponds or sub-surface pipes. Treatment must produce high-quality effluent to reclaimed water quality standards, Class A (unless a lesser level is allowed under pilot status) and treatment must include nitrogen removal. Reclaimed water standards are separate from DOH's five levels of treatment discussed previously in Section 5.2.2 and are organized into Classes A through D, with Class A being the most high-quality effluent. In addition to the general planning documents required by Ecology, water reuse projects also require a Water Reuse Permit.

The surface area of a percolation pond depends on the infiltration rate of the native soil. Using guidelines for design of stormwater infiltration ponds, the infiltration rate for a disposal facility in a groundwater protection area must not exceed 9 inches per hour (in/hr).

5.2.5 Reclaimed Water Use – Irrigation

Reclaimed water could also be "disposed" via irrigation. Treatment must produce Class A Reclaimed Water, but possibly may not require nitrogen removal. In addition to the general planning documents required by Ecology, water reuse projects also require a Water Reuse Permit.

Reclaimed water must be applied at average agronomic rates. For Washington State the rate is approximately 0.0033 mgd per acre. Irrigation is typically only needed during the growing season (May through September) so a back up means of disposal would have to be developed for other months.

5.3 Land Disposal Summary

Treated wastewater effluent can be disposed of on land through a land treatment system, a drainfield, subsurface drip system, percolation pond, or by irrigation. Treatment levels range from preliminary treatment to Class A reclaimed water. Drainfields must be sited on land with slopes less than 30 percent.

6.0 TREATMENT OPTIONS

A variety of on-site system treatment options are discussed in this section would meet treatment level requirements. Conceptually, the treatment system would be sited at a central location for each pocket and receive wastewater flow from individual homes and businesses through a collection system. Treated effluent would be either disposed on-site or pumped to a suitable disposal location.

6.1 Septic System

The basic component of most onsite treatment systems is a septic tank as shown in Figure 3. Wastewater enters a buried watertight tank, typically made from concrete, polyethylene or fiberglass. The tank is large enough to allow the solids in the wastewater to settle to the bottom of the tank and grease to float to the top. As new water enters the system, clarified, screened effluent flows out of the tank to further treatment (as described below) or directly to disposal. Septic systems will generally meet DOH treatment level E.

6.2 Sand Filters

A sand filter system is used to treat septic tank effluent on sites with minimal separation from the water table. The DOH has three different public domain sand filter technologies registered to meet different treatment levels:

1. Intermittent sand filter system: Expected treatment levels for various systems are provided in DOH's List of Registered On-site Treatment and Distribution Products effective April 2014. An intermittent sand filter system is capable of meeting DOH treatment levels B, C and D. The sand filter consists of a concrete or PVC containment vessel containing sand (Figure 4). The septic tank effluent is pumped through a network of pipes at the top of the filter, which distribute the effluent evenly to the filter. The septic tank effluent trickles through the sand and is further treated as it comes in contact with the biological community on the surface of the sand particles. The sand filter effluent is collected in the gravel underdrain before being pumped or flowing by gravity to the drainfield.
2. Sand-lined trenches: The sand-lined trench is capable of meeting DOH treatment level B and C. The sand-lined trench relies on the same treatment principle as the intermittent sand filter, however the sand is contained in trenches or beds instead of a containment vessel. The sand-lined trench acts as both a treatment and disposal method (Figure 5).
3. Stratified sand filter system: A stratified sand filter system is capable of meeting DOH treatment level A and B. The stratified sand filter is a relatively new technology and is a modified intermittent filter. The stratified sand filter contains layers of sands with different particle sizes, allowing a higher quality effluent than an intermittent sand filter. Oxygen is also provided at the interface between the different sand layers through a vent pipe (Figure 6).

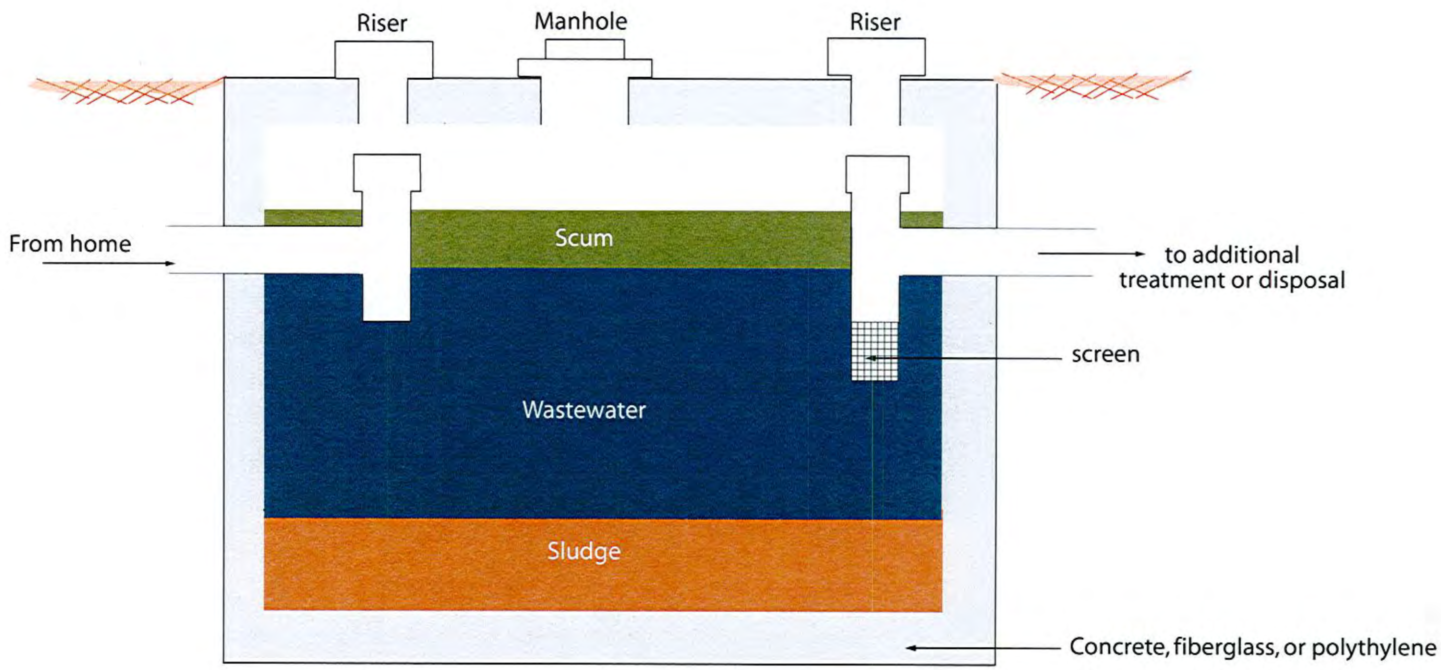

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Figure 3
Typical Septic System Schematic
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General Sewer Plan
City of Bainbridge Island

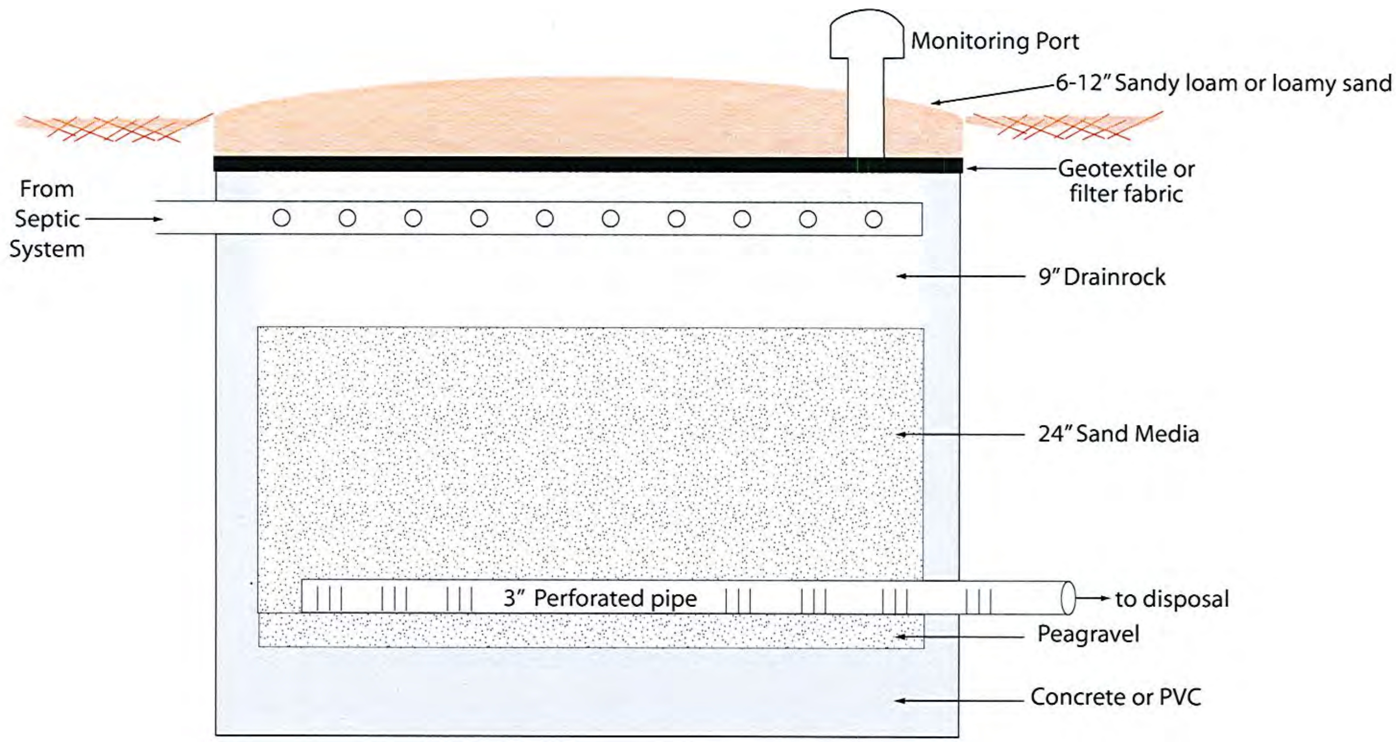

Figure 4
Intermittent Sand Filter
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General Sewer Plan
City of Bainbridge Island

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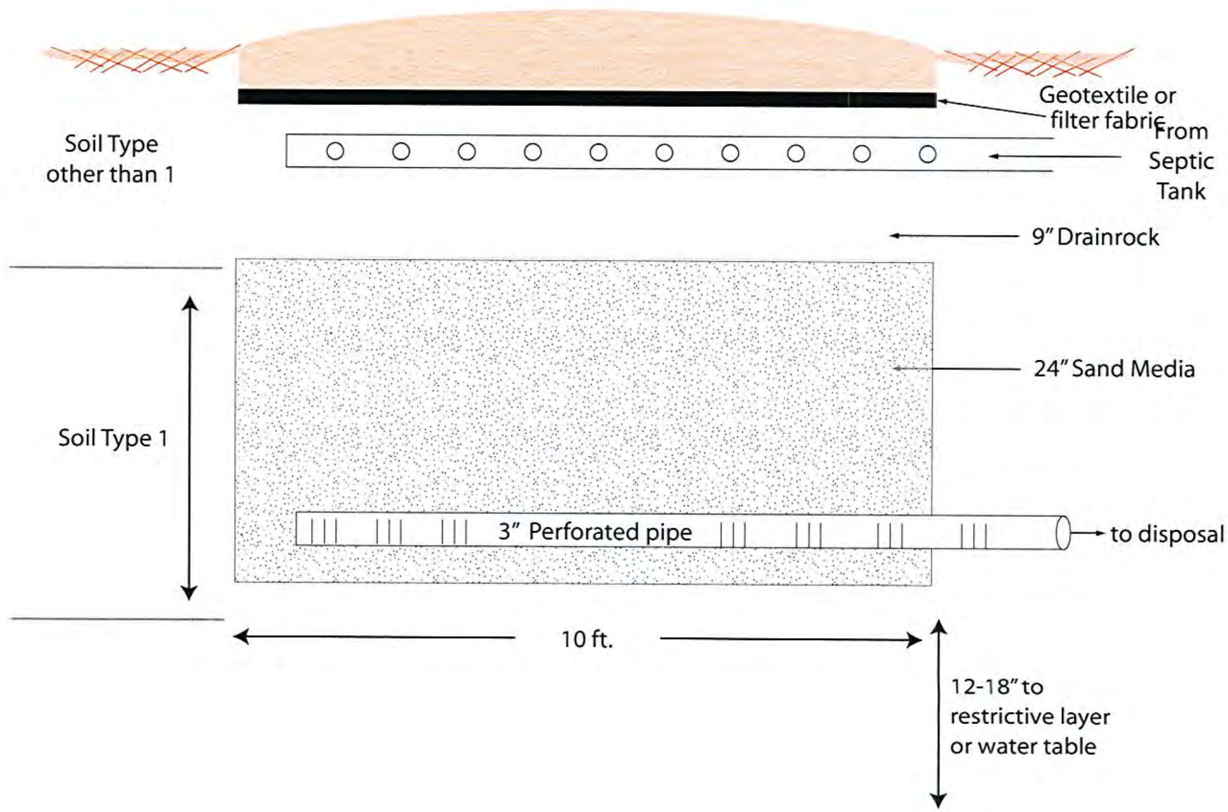

Figure 5
Sand Lined Trench
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General Sewer Plan
City of Bainbridge Island

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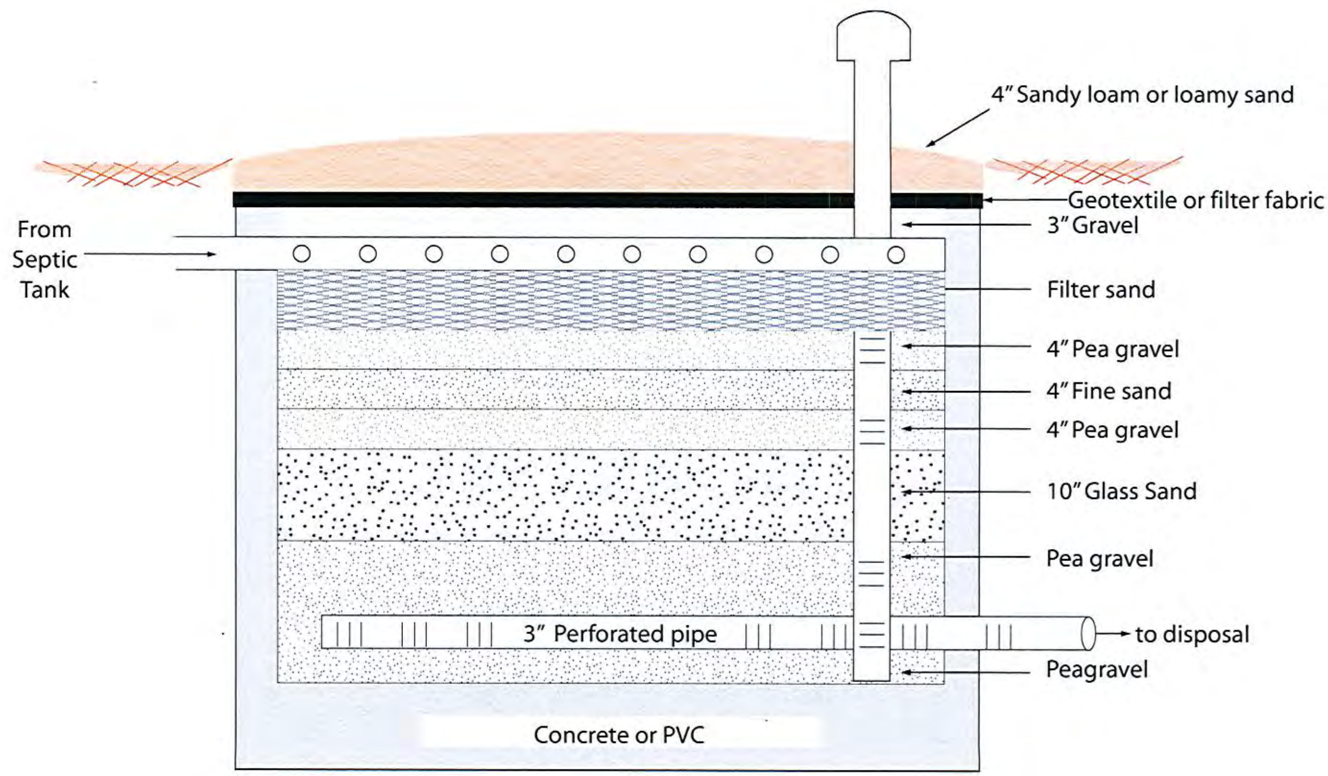

Figure 6
Stratified Sand Filter
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General Sewer Plan
City of Bainbridge Island

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6.3 Recirculating Gravel Filter System

The recirculating gravel filter system is capable of meeting the DOH treatment levels C and D. The recirculating gravel filter system is similar to a sand filter in that the septic tank effluent is further treated by bringing the effluent into close contact with a biological community on the surface of the filter media. For a recirculating gravel filter, the filter media is pea gravel contained in a watertight vessel (Figure 7). The filter effluent is split: a portion of the effluent flows to the drainfield and a portion is mixed with the septic tank effluent and returns to the gravel filter. The gravel filter system has a smaller footprint than the intermittent sand filter and is not as susceptible to hydraulic overloading.

6.4 Mound System

For a mound system, septic tank effluent is pumped to the "mound". The mound consists of filter media over an infiltration bed and a soil cap (Figure 8). The septic tank effluent is further treated as it flows through the filter media and comes in contact with the biological community on the filter media. The mound system is capable of meeting DOH treatment levels B and C and acts as both a treatment and distribution system. The WA DOH warns of several potential problems with a mound system, the most prevalent relating to siting and design issues.

6.5 Aerobic Treatment Unit

The DOH has registered several proprietary systems capable of further treating septic tank effluent. Many of these systems are aerobic treatment units (ATU) as shown in Figure 9. In the ATU, the septic tank effluent is treated in an aerated watertight vessel. The ATU is similar to a conventional activated sludge and secondary clarifier in one unit. The septic tank effluent is food for the aerobic bacteria growing in the ATU, and as the biological flocs increase in size they settle out and are digested on the bottom of the tank. Periodically, the aeration chamber is partially pumped, to remove some of the solids from the system. Depending on the system, ATUs can meet DOH treatment levels A through D.

6.6 Membrane Bioreactor

Membrane bioreactors (MBR) are a compact wastewater treatment process. Many manufacturers make a compact, self-contained MBR plant to treat flows of approximately 20,000 gpd to 100,000 gpd (Figure 10). For the 20,000-gpd system, the unit is contained in a 25-foot long tube with a 12-foot diameter. In the MBR process, the wastewater is first screened then aerated. The mixed liquor from the aeration tank is generally pumped into a membrane tank containing several membrane cassettes. Permeate pumps pull the clean water through the membrane filters leaving behind a very concentrated biologically active solids stream. A portion of the solids is wasted and the remaining portion is returned back to the aeration tank. An MBR process is capable of producing a high quality effluent, meeting class A reclaimed water standards. Thus, several different disposal options, including percolation ponds and irrigation can be used with membrane bioreactors.

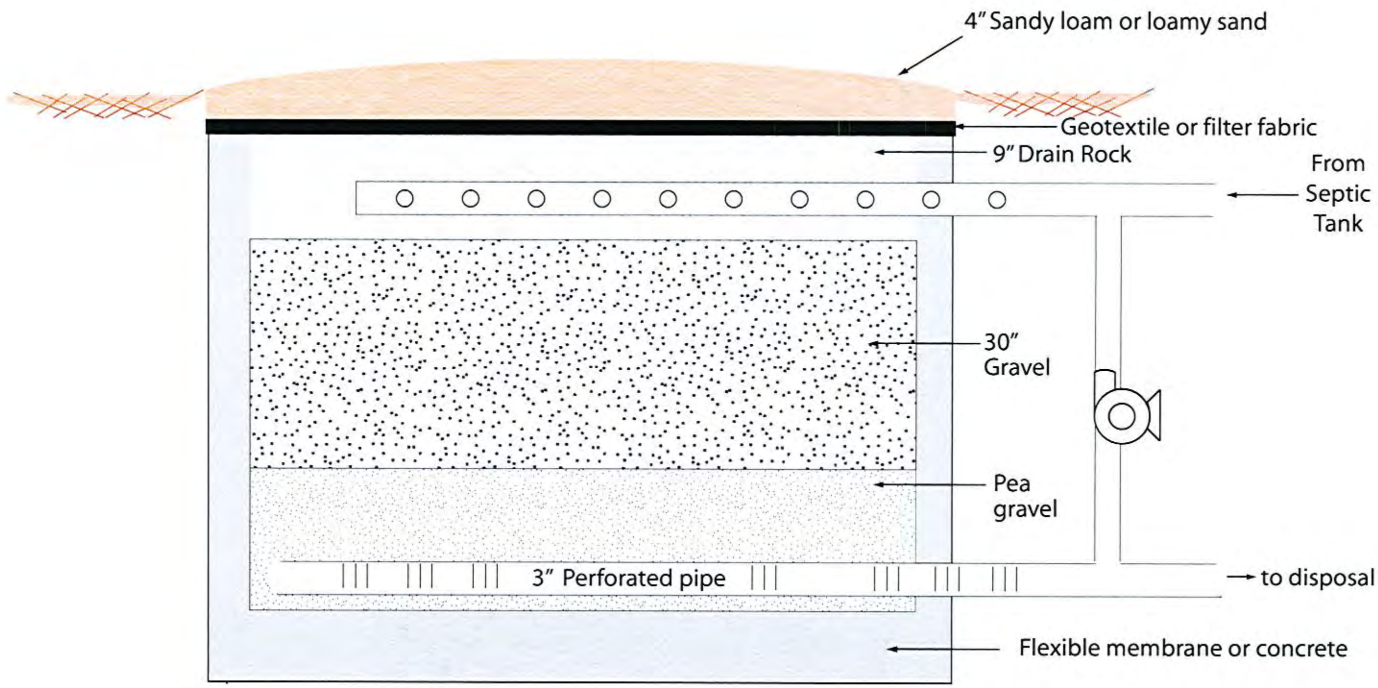

Figure 7
Recirculating Gravel Filter
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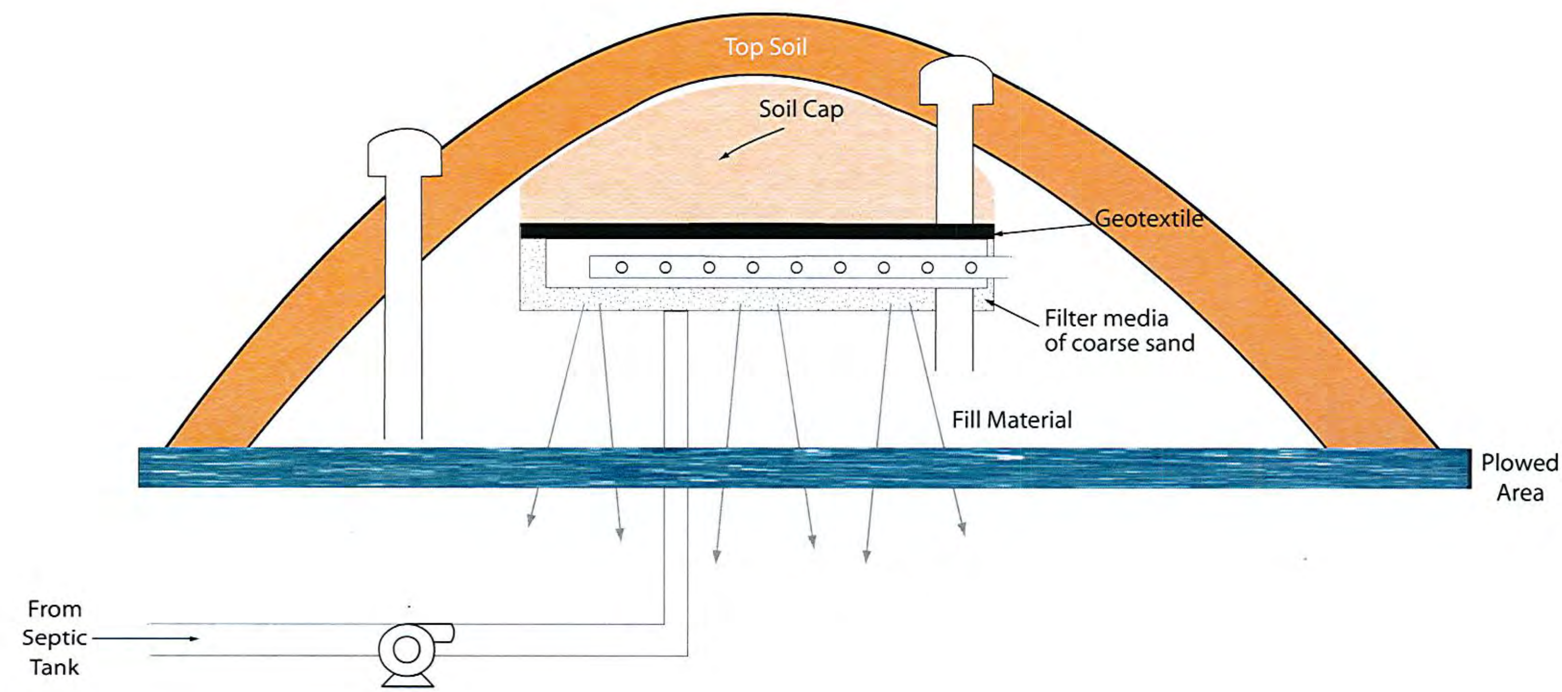

Figure 8
Mound System
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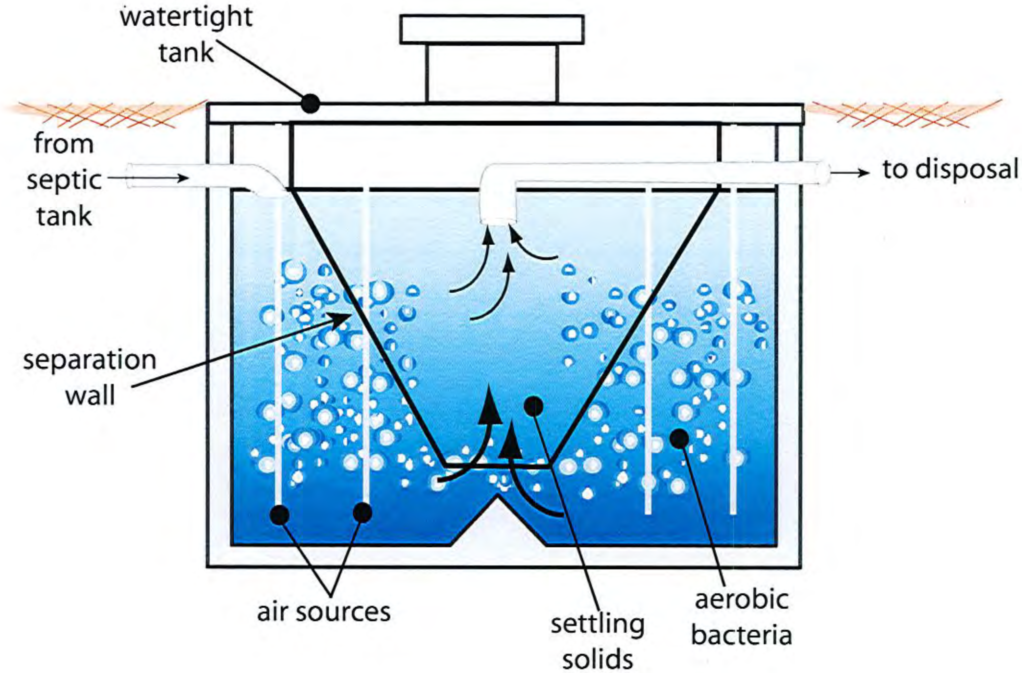

Figure 9
Aerobic Treatment Unit
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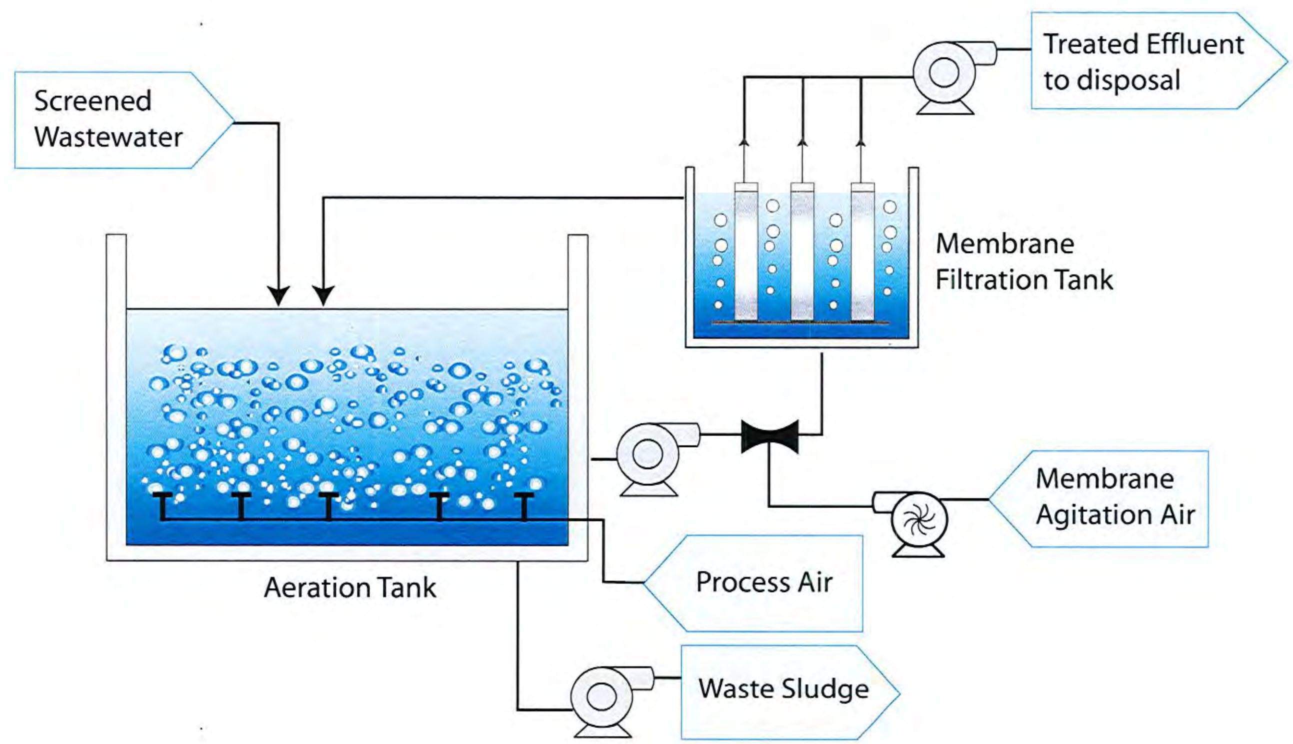

Figure 10
Membrane Bioreactor
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General Sewer Plan
City of Bainbridge Island

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7.0 OPTION SELECTION

For purposes of selecting onsite treatment/disposal combinations to consider in greater detail, each of the six treatment options was combined with the allowable disposal option that required the smallest footprint. The combinations considered are community septic tank/drainfield, sand filter/SDS, recirculating gravel filter/SDS, mound system, ATU/SDS, MBR/percolation pond. In order to select two treatment/disposal combinations for further consideration, each option was rated based on five criteria including reliability, acreage requirements, operation and maintenance requirements, capital cost, and effluent quality.

The two options that emerge as the best options for further evaluation according to Table 7.1 are community septic tank/drainfield and MBR/percolation pond. Costs, acreage requirements and layouts for these two options are provided in Section 8.0.

Table 7.1 Option Selection Matrix
General Sewer Plan
City of Bainbridge Island

Option No.	Treatment	Disposal	Reliability		Acreage Requirements		O&M Requirements		Construction Cost		Effluent Quality		Score
			Level	Score	Level	Score	Level	Score	Level	Score	Level	Score	
1	Septic Tank	Drainfield	High	3	High	1	Low	3	Low	3	Low	1	11
2	Sand Filter	Subsurface Drip System	Medium	2	Medium	2	Medium	2	Medium	2	Medium	2	10
3	Recirculating Gravel Filter	Subsurface Drip System	Medium	2	Medium	2	Medium	2	Medium	2	Low	1	9
4	Mound System	Mound System	Low	1	Medium	2	High	1	Medium	2	Medium	2	8
5	Aerobic Treatment Unit	Subsurface Drip System	Medium	2	Medium	2	High	1	Medium	2	Medium	2	9
6	Membrane Bioreactor	Percolation Pond	High	3	Low	3	High	1	Medium	2	High	3	12

8.0 OPTION COMPARISON

To provide a general estimate of land requirements and capital costs, three treatment/disposal combination options were compared for the Mid-Island Study Area. The first option is conveyance of Mid-Island wastewater to the Winslow Collection System for treatment at the Winslow Wastewater Treatment Plant. The second option is installation of community septic tanks and drainfields for each of the Mid-Island pockets. The third option considered is installation of packaged MBR systems with groundwater disposal through percolation ponds. These three options represent solutions that span the range technological approaches and disposal options available to the City. Other options may also be applicable. Each of the three options is described below. Capital cost estimates for each system are included in Table 8.1. Detailed cost development tables are provided in Attachment A. Development of the collection systems for each Mid-Island pocket is not considered herein because they would be similar regardless of the treatment/disposal option selected.

Table 8.1 Mid-Island Treatment Options Capital Cost Estimates
General Sewer Plan
City of Bainbridge Island

Treatment Option	Land Required (acres)	System Construction Cost
Conveyance to Winslow Collection System		
Eastern Pocket	0	$2,000,000
Western Pocket	0	$2,000,000
Community Septic Tanks with Conventional Drainfields		
Eastern Pocket	2	$1,000,000
Western Pocket	24	$10,300,000
MBR Package Plants with Percolation Ponds		
Eastern Pocket	0.5	$2,800,000
Western Pocket	1.5	$4,600,000

8.1 Conveyance to the Winslow Collection System

To convey wastewater from the Mid-Island pockets to the Winslow WWTP, a new pump station and force main would need to be constructed for each pocket. The 4-inch diameter force mains from each pocket would have an approximate length of 11,500 ft and would connect to the Winslow Collection System near the Woodward School and North Town Pump Stations.

The amount of flow contributed to the Winslow Collection System by the Mid-Island pockets would account for an additional 2 percent on top of the 0.72-mgd ADWF projected for 2035 for the Winslow Collection System. As shown in Table 8.1, the estimated capital cost for this option is $2.0 million for each pocket.

8.2 Community Septic Tanks with Conventional Drainfields

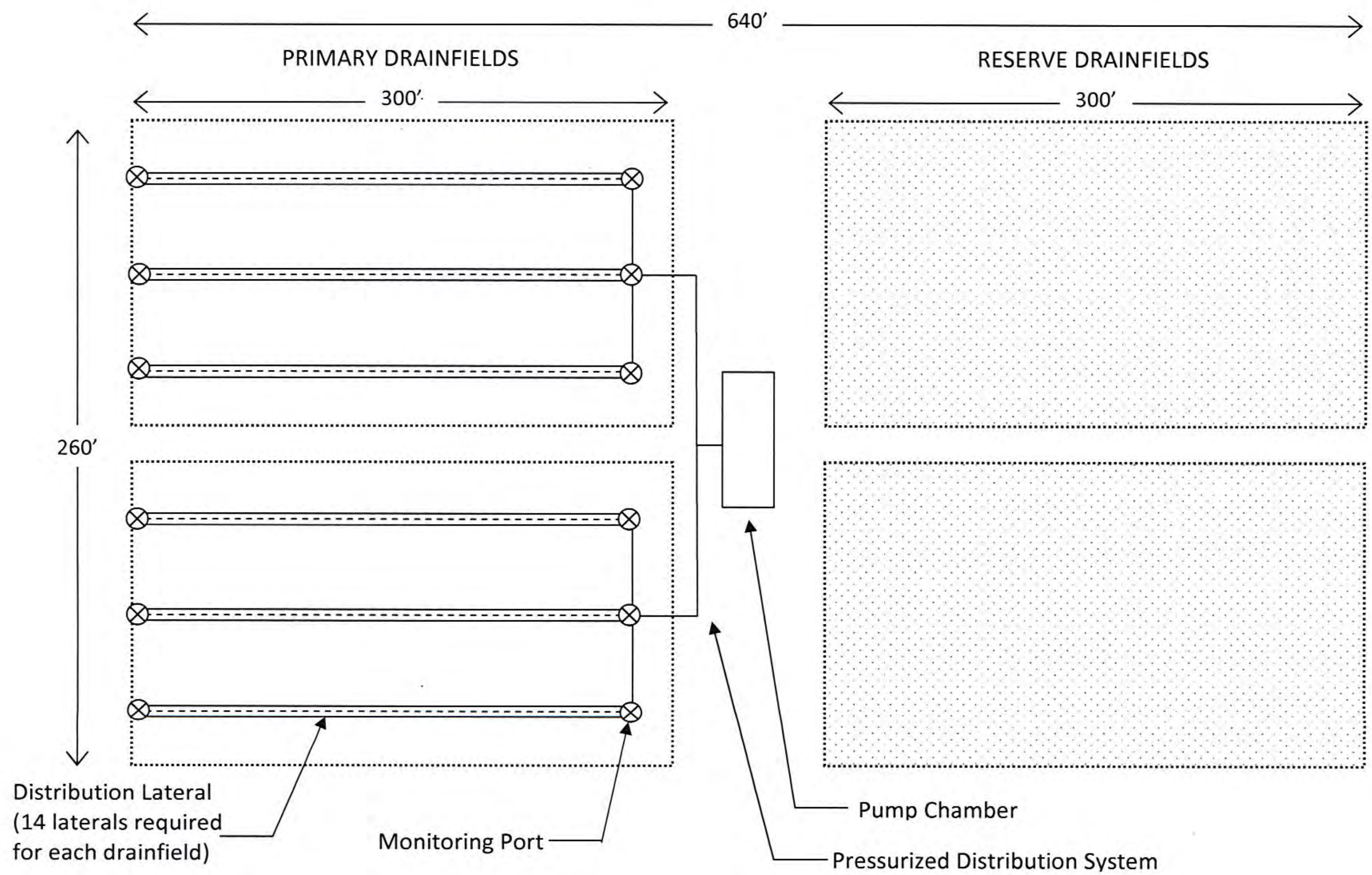
The second option consists of installing a community septic tank with a conventional drainfield for each Mid-Island pocket. The collection systems for each pocket would convey wastewater to an underground septic tank large enough to allow solids in the wastewater to settle to the bottom and grease to float at the top. As wastewater enters the septic tank, clarified, screened effluent flows out of the tank to drainfields. Figure 11 depicts a typical drainfield section sized to handle 15,000 gpd that includes a pump chamber, pressurized distribution system, monitoring ports, distribution laterals, and reserve drainfields. Six such sections are required for to treat the full projected flows of the western pocket. One half of one section shown in Figure 11 is needed for to treat the 7,710 gpd peak flows of the eastern pocket. The land required for a drainfield for the study area was determined using the minimum spacing requirements and allowances and assumed fine sandy soils with a loading rate of 0.6 gal/sf/day. Setbacks and a reserve drainfield area of 100 percent is included in the area estimates.

The eastern pocket would require approximately an 8,000-gallon capacity septic tank with a drainfield spanning nearly two acres. The western pocket would require a 40,000-gallon septic tank with drainfields covering approximately 24 acres. The estimated capital cost of this option for the eastern and western pockets is $1.0 and $10.3 million, respectively.

8.3 MBR Package Plants with Percolation Ponds

The final option considered involves installation of MBR package plants with groundwater percolation ponds. MBRs are a compact wastewater treatment process. Many manufacturers make self-contained MBR package plants to treat flows of approximately 20,000 to 150,000 gpd. An example layout for and MBR system with percolation ponds is presented in Figure 12.

With an ADWF of 2,570 gpd, the eastern pocket is probably too small to warrant the installation of an MBR system, however estimated land requirements and capital costs are shown in Table 8.1. An MBR packaged plant is well-sized for the western pocket. Percolation ponds for the western pocket would require approximately 1.5 acres and the capital cost of the system is estimated at $4.6 million.



Total Area: ~4.0 acre
Drainfield sized for 15,000 gpd
Six (6) drainfields needed for Western Pocket Flow (39,060 gpd)
One (1) drainfield half this size needed for Eastern Pocket Flow (7,710 gpd)

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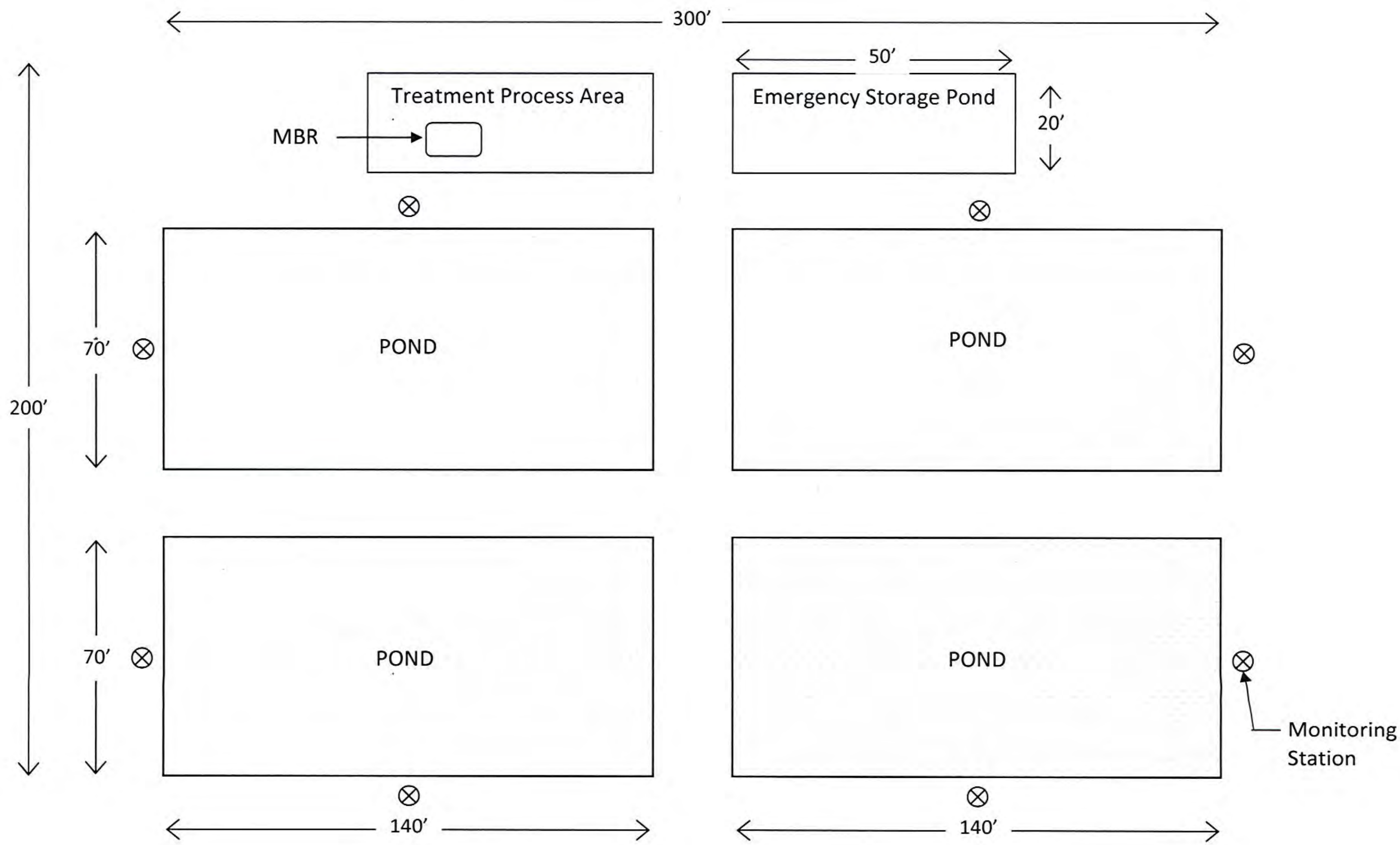
Figure 11
Drainfield Schematic
PM 1 – Mid-Island Study Area Sewer Service Options
General Sewer Plan
City of Bainbridge Island



Total Area: ~1.5 acres
Percolation Ponds sized for peak hour flow of 40,000 gpd (Western Pocket)
Approximate Percolation Pond area of 8,000 sf required for Eastern Pocket

Figure 12
MBR/Percolation Pond Schematic
PM 1 – Mid-Island Study Area Sewer Service Options
General Sewer Plan
City of Bainbridge Island

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9.0 SUMMARY

Many sewer treatment and disposal options exist for the Mid-Island Study Area pockets. The level of treatment required, and therefore the treatment process selected, depends on the chosen disposal method. Three treatment and disposal combinations were considered for each pocket: conveyance to the Winslow Collection System, community septic tanks and drainfields, and MBRs with percolation ponds. These combinations span the range of treatment level and disposal options. Based on this analysis, the most cost-effective method of treatment and disposal for the eastern pocket is the installation of a community septic tank with a conventional drainfield. This option is estimated to cost $1,000,000. The most cost-effective option for the Western Pocket is construction of a pump station and force main for conveyance to the Winslow Collection System. This option is estimated to cost approximately $2,000,000.

Prepared By:

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Alena Bennett

Attachment A

DETAILED COST DEVELOPMENT

City of Bainbridge Island
General Sewer Plan
PM 1 - Mid-Island Study Area Sewer Service Options

ELEMENT: CONVEYANCE TO WINSLOW COLLECTION SYSTEM

Description	Quantity	Unit	Unit Cost	Subtotal
4" Force Main from Western Pocket	11,500	LF	$ 70	$ 805,000
4" Force Main from Eastern Pocket	11,500	LF	$ 70	$ 805,000
Connection to Winslow Collection System	2	EA	$ 3,500	$ 7,000
Pump Stations	2	EA	$ 400,000	$ 800,000
DIRECT COST				$ 2,417,000
CONTINGENCY			30%	$ 725,100
SUBTOTAL				$ 3,142,100
GENERAL CONDITIONS (10%) OH&P (15%)			27%	$ 848,367
TOTAL ESTIMATED CONSTRUCTION COST				$ 3,990,467

City of Bainbridge Island
General Sewer Plan
PM 1 - Mid-Island Study Area Sewer Service Options

ELEMENT: COMMUNITY SEPTIC TANK AND DRAINFIELD

Description	Quantity	Unit	Unit Cost	Subtotal
Western Pocket				
Land Acquisition	24	AC	$ 100,000	$ 2,400,000
Septic Tank Excavation	1,200	CY	$ 12	$ 14,368
Septic Tank	40,000	gal	$ 6	$ 240,000
Site Work - Clear and Grub	24	AC	$ 468	$ 11,236
Site Work - Grading	350,000	SF	$ 2	$ 578,302
Site Work - Electrical	1	EA	$ 50,000	$ 50,000
Drainfield Excavation	16,800	CY	$ 12	$ 201,148
Haul Excavated Materials	18,000	CY	$ 24	$ 431,032
6" Perforated PVC	40,000	LF	$ 17	$ 670,495
Monitoring Stations	168	EA	$ 84	$ 14,080
Gravel Backfill	16,800	CY	$ 79	$ 1,327,580
Pressure Distribution System	6	LS	$ 54,000	$ 324,000
DIRECT COST				$ 6,262,241
CONTINGENCY			30%	$ 1,878,672
SUBTOTAL				$ 8,140,913
GENERAL CONDITIONS (10%) OH&P (15%)			27%	$ 2,198,047
TOTAL ESTIMATED CONSTRUCTION COST				$ 10,338,960

City of Bainbridge Island
General Sewer Plan
PM 1 - Mid-Island Study Area Sewer Service Options

ELEMENT: COMMUNITY SEPTIC TANK AND DRAINFIELD

Description	Quantity	Unit	Unit Cost	Subtotal
Eastern Pocket				
Land Acquisition	2	AC	$ 100,000	$ 200,000
Septic Tank Excavation	650	CY	$ 12	$ 7,783
Septic Tank	8,000	gal	$ 6	$ 48,000
Site Work - Clear and Grub	2	AC	$ 468	$ 936
Site Work - Grading	25,000	SF	$ 2	$ 41,307
Site Work - Electrical	1	EA	$ 50,000	$ 50,000
Drainfield Excavation	1,400	CY	$ 12	$ 16,762
Haul Excavated Materials	2,050	CY	$ 24	$ 49,090
6" Perforated PVC	3,300	LF	$ 17	$ 55,316
Monitoring Stations	28	EA	$ 84	$ 2,347
Gravel Backfill	1,400	CY	$ 79	$ 110,632
Pressure Distribution System	0.5	LS	$ 54,000	$ 27,000
DIRECT COST				$ 609,172
CONTINGENCY			30%	$ 182,752
SUBTOTAL				$ 791,924
GENERAL CONDITIONS (10%) OH&P (15%)			27%	$ 213,820
TOTAL ESTIMATED CONSTRUCTION COST				$ 1,005,744

City of Bainbridge Island
General Sewer Plan
PM 1 - Mid-Island Study Area Sewer Service Options

ELEMENT: MEMBRANE BIOREACTOR/PERCOLATION POND

Description	Quantity	Unit	Unit Cost	Subtotal
Western Pocket				
Land Acquisition	1.5	AC	$ 100,000	$ 150,000
Site Work - Clear and Grub	1.5	AC	$ 468	$ 702
Site Work - Electrical	1	EA	$ 50,000	$ 50,000
Influent Pumping	1	EA	$ 390,000	$ 390,000
MBR Packaged Plant	1	EA	$ 1,500,000	$ 1,500,000
Solids Storage	1	EA	$ 100,000	$ 100,000
Site Facilities	1	EA	$ 300,000	$ 300,000
Standby Generator	1	EA	$ 180,000	$ 180,000
Pond Excavation	7,300	CY	$ 12	$ 87,404
Emergency Pond Excavation	500	CY	$ 12	$ 5,987
Emergency Pond Liner	1,500	SF	$ 1	$ 1,796
Monitoring Stations	8	EA	$ 870	$ 6,960
DIRECT COST				$ 2,772,849
CONTINGENCY			30%	$ 831,855
SUBTOTAL				$ 3,604,703
GENERAL CONDITIONS (10%) OH&P (15%)			27%	$ 973,270
TOTAL ESTIMATED CONSTRUCTION COST				$ 4,577,973

City of Bainbridge Island
General Sewer Plan
PM 1 - Mid-Island Study Area Sewer Service Options

ELEMENT: MEMBRANE BIOREACTOR/PERCOLATION POND

Description	Quantity	Unit	Unit Cost	Subtotal
Estern Pocket				
Land Acquisition	0.5	AC	$ 100,000	$ 50,000
Site Work - Clear and Grub	0.5	AC	$ 468	$ 234
Site Work - Electrical	1	EA	$ 50,000	$ 50,000
Influent Pumping	1	EA	$ 390,000	$ 390,000
MBR Packaged Plant	1	EA	$ 750,000	$ 750,000
Solids Storage	1	EA	$ 50,000	$ 50,000
Site Facilities	1	EA	$ 100,000	$ 100,000
Standby Generator	1	EA	$ 180,000	$ 180,000
Pond Excavation	7,300	CY	$ 12	$ 87,404
Emergency Pond Excavation	500	CY	$ 12	$ 5,987
Emergency Pond Liner	1,500	SF	$ 1	$ 1,796
Monitoring Stations	8	EA	$ 870	$ 6,960
DIRECT COST				$ 1,672,380
CONTINGENCY			30%	$ 501,714
SUBTOTAL				$ 2,174,095
GENERAL CONDITIONS (10%) OH&P (15%)			27%	$ 587,006
TOTAL ESTIMATED CONSTRUCTION COST				$ 2,761,100

Island Center Subarea Plan Outline