STORMWATER CONTROL STRATEGY AND ACTION PLAN FOR THE SWAN LAKE WATERSHED

with particular attention to federal EPA guidance and regulations for small community stormwater management plans

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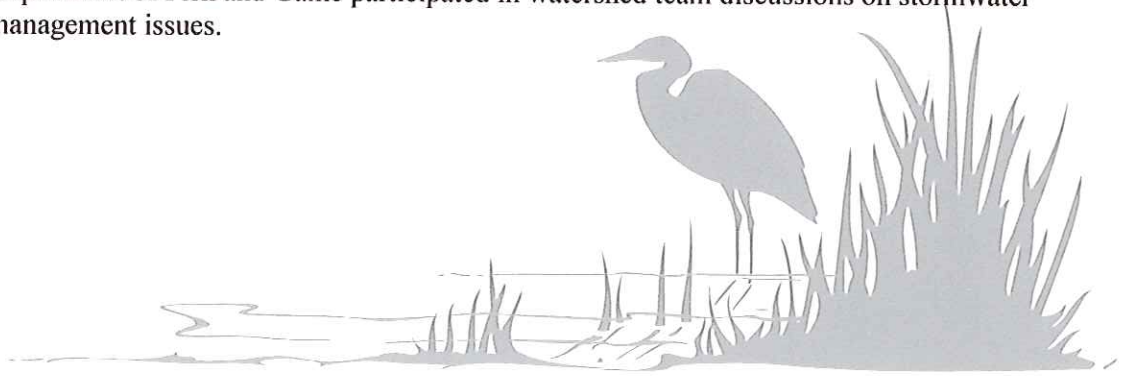

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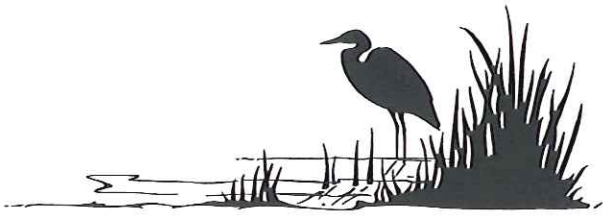

Redburn Environmental & Regulatory Services

"Linking science with responsible public policy"

JUNE 2002

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I. OVERVIEW

This report is a Strategy for managing stormwater runoff in the Swan Lake watershed. It describes the sources and pathways of stormwater runoff, existing water quality conditions, and current stormwater controls, authorities and management practices. The adequacy of existing stormwater controls in the Swan Lake watershed is evaluated against the Environmental Protection Agency's (EPA) six regulatory elements that constitute a complete program. An Action Plan of over twenty tasks is proposed to improve stormwater management and quality.

The Action Plan proposes a proactive, preventive approach to stormwater management, recognizing that small community response to stormwater management is often reactionary in response to problems. Both approaches must be part of a comprehensive Strategy.

Over the last three years, considerable effort has gone into developing and carrying out the *Swan Lake Watershed Recovery Strategy and Eutrophication Action Plan.* Completed in June 2000, this document directs the restoration of Swan Lake and it feeder streams through a broad range of tasks. Important among these tasks are several stormwater controls designed to improve water quality in the lake and creeks.

In particular, Task 8 of the *Swan Lake Watershed Recovery Strategy* provided the impetus for this report.

> *"Complete a stormwater management plan for the Swan Lake watershed"*
>
> "Key provisions of the plan are envisioned to be eventually adopted into a local stormwater ordinance. The stormwater plan for Swan Lake will guide engineering, construction and stormwater maintenance practices. It can also serve as guidance for a broader community stormwater plan."

In June 2001, the City and Borough of Sitka (CBS) received a Section 319 community water quality grant from the Alaska Department of Environmental Conservation (ADEC) to complete a Swan Lake Stormwater Control Strategy by June 30, 2002.

Stormwater control has two main aspects. One is to address the increased volume and rate of runoff from impervious surfaces. The second is to control the pollutants in the runoff. Pollutants may includes oils and greases, sediment, salts, nutrients, heavy metals, antifreeze and a variety of organic compounds. Effective management of stormwater runoff offers a multitude of benefits, including protection of Swan Lake - the endpoint of all runoff in the watershed - flood control, and protection of public health.

Stormwater drainage to Swan Lake is considerable. A series of neighborhood roadside drainage ditches, culverts, and catch basins/underground collection systems transport stormwater to Swan Lake. Underground collection/drainage is generally restricted to the main roads, including

Halibut Point Road, Lake Street, DeGroff and Marine Street and some of Lakeview Street. Over twenty (20) separate outfalls discharge stormwater to Swan Lake. The quality of stormwater has been monitored for sediments and turbidity levels and oil sheens over the last several years. Stormwater discharges to Swan Lake carry runoff and chemicals from roads, residences and parking lots. Sediment catchment basins are installed in storm drains on Halibut Point Road, Lake Street, Marine and DeGroff Streets and south Lakeview Street. Several oil/water separators (OWSs) are installed along Halibut Point Road, but the State DOT&PF has an unspecified maintenance schedule for OWSs. Lake Street is sloughing/eroding sediments into Swan Lake. Allegations of leaking municipal sewer lines along Lake Street persist. Fill encroachments on the natural channels and vegetated stream buffers of Arrowhead and Wrinkleneck Creeks have had a marked effect on drainage, and increase flooding frequency on some streets. Other hydrologic modifications to the watershed that have also affected stormwater quality include road paving and land clearing. The recently-completed dredging projects at the Swan Lake outlet channel and the Wrinkleneck Creek delta have helped moderate extremes and fluctuations in lake height and stream elevations.

The main sources of stormwater affecting Swan Lake's water quality are urban runoff and land use management practices within the watershed. Several of these have been effectively dealt with over the last 30 years (e.g. municipal sewage collection system replacing septic tanks); many remain to be addressed. While Swan Lake is not listed by the Department of Environmental Conservation as violating water quality standards for dissolved oxygen, nutrients, sediments, or fecal coliform bacteria, low level inputs over time are gradually resulting in excessive plant growth and recreational use impairments. Priority actions over the last several years have been directed at understanding and controlling the causes of eutrophication coupled with actively treating the symptoms of lake eutrophication. Stormwater management is an integral part of this effort.

The Stormwater Control Strategy recognizes the unique conditions of Swan Lake in selecting appropriate best management practices. A number of good management practices are already in place to improve stormwater quality. These are individually acknowledged in the Strategy and should be continued. Several new practices are proposed.

The Environmental Protection Agency (EPA) has regulated stormwater discharges through its National Pollutant Discharge Elimination System (NPDES) permit program since the early 1990s. Regulated sources include construction sites, industrial operations, and municipal stormwater systems. EPA issued final "Phase II" stormwater regulations in December 1999 that generally require some smaller municipalities to prepare stormwater management plans. With a population below 10,000 citizens, it is unlikely at this writing that the CBS will be required by EPA to complete a Phase II stormwater plan for the municipality (Laura Eldred, personal communication). If a plan is required (EPA is expected to make a decision by December 2002), the approach proposed here for the Swan Lake watershed will prove useful as a model for a broader municipal-wide plan.

Regardless of the outcome of this federal decision, the Swan Lake Stormwater Control Strategy includes a common sense set of tasks that will only improve stormwater management into the future. The Swan Lake Stormwater Control Strategy is structured to address EPA's six minimum control measures - or elements - for an approvable plan, recognizing that CBS may not be formally required to complete such a plan for the entire municipality. The elements/measures make good sense and it is felt prudent at this point to address them as guidance for purposes of this Strategy. A useful program reference is the EPA Office of Waters' website "Stormwater Phase II Menu of BMPs and Model Permits" at *www.epa.gov/npdes/menuofbmps/menu.htm.* Links to additional relevant stormwater information are included.

The six minimum elements of a stormwater management plan, with *federal requirements in italics,* are:

1. Public education and outreach

   "Implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities on steps the public can take to reduce pollutants in stormwater runoff"

2. Public involvement and participation

   "Comply with state and local public notice requirements when implementing a public involvement/participation program"

3. Detection and elimination of illicit discharges

   "Develop, implement and enforce a program to detect and eliminate illicit discharges into the municipal stormwater system"

4. Controlling construction site stormwater runoff

   "Develop, implement and enforce a program to reduce pollutants in any storm water runoff to the municipal system from construction activities that result in land disturbance of greater than one acre."

5. Managing stormwater runoff from new developments after construction

   "Develop, implement and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than one acre that discharge into the municipal stormwater system. Strategies must include a combination of structural and non-structural best management practices appropriate to the community."

6. Good housekeeping practices and pollution prevention

> *"Develop and implement an operation and maintenance program that includes a training component with the goal of preventing or reducing pollutant runoff from municipal operations."*

Best management practices (BMPs) specific to each of these control measures are discussed later in the report. EPA provides a "menu' of BMPs from which to choose and tailor to site-specific conditions in Swan Lake.

Many of the federal stormwater control measures emphasize prevention vs. treatment. Once pollutants are present in a waterbody, or after its habitat is physically modified, it is much more difficult and expensive to restore it. Therefore, a Strategy that focuses on *preventing* degradation is emphasized. This is particularly important recognizing that Swan Lake has been the subject of considerable restoration effort over the past three years. These efforts have included lake dredging, citizen monitoring, aquatic plant harvest, BMP brochures for watershed homeowners, and annual spring cleanups of trash and debris.

It is hoped that the *Swan Lake Stormwater Control Strategy and Action Plan* will foster improved coordination between the various CBS departments with land use responsibilities, result in a review of local ordinances to determine if existing requirements should be strengthened, and improved operation and maintenance practices. Where no specific ordinance exists to comprehensively address stormwater, it is recommended that one at least be considered. Reviewing model ordinances of other communities of similar size and financial capability as Sitka would be a necessary first step. Examples issues include sewer overflows, erosion and sediment control BMPs, operation and maintenance practices, and penalties for non-compliance. Formally integrating stormwater management into the CBS land development and building permit process is proposed. Site plan reviews, building permits, conditional land use permits, and planning and zoning are key tools to achieve this. CBS has ample authority to affect such changes.

Public education and involvement are key elements of an effective stormwater management plan, just as they have been for the preceding *Swan Lake Watershed Recovery Strategy*. The targeted audience for Swan Lake includes building contractors and developers, the City and Borough of Sitka, lakeside and stream side residents, students, recreationalists and citizen volunteers who have helped with past lake restoration efforts. Several groups are already established and participate in ongoing lake restoration work.

A stormwater control strategy must have a management structure. A *goal* and supporting *objectives* are included below. Implementation *tasks, responsible parties,* and a *schedule* are provided in the Action Plan. *Measures of success* are necessary to evaluate whether the objective (supported by various tasks) is met. The Action Plan includes measures of success for each task.

Structural (e.g. sediment catch basins, grassy swales, stream side buffers) and non-structural controls (such as street cleaning, stream bank management, road salt application and snow plowing) are described. Regular maintenance plays a vital role in ensuring the proper operation of both structural and source controls.

Lastly, carrying out an effective stormwater management strategy requires staffing, equipment and funding. Several of the newly-proposed tasks will require new funding. Effective management also requires close coordination between various departments within the CBS. The Public Works Department is the logical "lead entity" for coordinating the development and implementation of a stormwater control strategy, recognizing that several departments, private developers and the public will have significant roles.

1. The "Problem Statement": Why are we doing this?

A Stormwater Control Strategy must be linked to current water quality conditions in the lake. Residential development and urban runoff to the lake and Arrowhead and Wrinkleneck Creeks pose a threat to water quality and habitat values, and accelerate the natural lake aging process. Swan Lake suffers from an overabundance of native aquatic plants, rich organic deposits, periodic depression in dissolved oxygen levels and impedes access for recreational boating and fishing. Much of this is a natural process of lake aging. The lake is slowing filling up with organic material, much of which are not being oxidized or broken down in deeper bottom sediments. Sediments are introduced from stormwater discharges and road erosion. While no winter fish kills of resident trout have been documented (Tom Brookover, personal communication), concerns remain about depressed levels of dissolved oxygen under winter ice, particularly at the lake bottom, and effects on the fisheries. Shoreline areas near the spit used for launching inflatables are overgrown. Recreational boating and sport fishing access and fishing from the shoreline are constrained due to a dense assemblage of yellow lilies, pondweed and emergent vegetation. The few existing homeowner docks are overgrown. Recreational use impairment and aesthetics are the most visible problems but water quality concerns are lurking.

Accumulation of native aquatic vegetation in lakes is a common result of the natural succession of shallow lakes to vegetated wetlands and, eventually, to terrestrial habitat. Active management will be necessary to slow this process, including controls on stormwater quality. Introducing sediments, nutrients and oils and greases to the lake can have dramatic effects on the composition of the aquatic plant community, and particularly its density and location. Sedimentation can also affect water flow into and out of the lake.

Raw sewage inputs to Swan Lake from septic tanks were effectively halted with the installation of the municipal sewage collection system. Some allegations have occurred of cracked sewer lines or improper hookups to the city mains along Lake Street but dye studies, lake sampling of fecal coliform bacteria and on-site engineering investigations have not confirmed major problems.

2. Watershed Management Objectives: The Swan Lake Area Meriting Special Attention

The management objectives for the Swan Lake watershed are perhaps best expressed in the goals and proper/improper uses codified in the *Swan Lake Area Meriting Special Attention (AMSA)*. The Swan Lake AMSA, designated in 1981 under the Sitka District Coastal Management Program, includes the following "purpose statements" that are relevant to stormwater management:

- "✔Insure a clean, aesthetically pleasing fresh water body within the roaded area of Sitka to be enjoyed and utilized by the public;

- ✔Maintain and enhance the resident fish population within the Swan Lake watershed for the recreational enjoyment and use of the public;

- ✔Protect and preserve that habitat attractive to swans and associated waterfowl utilizing Swan Lake; and,

- ✔Provide for recreational activities and development practices consistent with the protection and sound management of the lake's resources and habitats as outlined in this management proposal."

Proper and improper uses identified in the Swan Lake AMSA are included in the Sitka District Coastal Management Program and have the status of enforceable policies.

Improper uses germane to the Swan Lake Stormwater Control Strategy include:

- Development of permanent structures or land clearing within the 50 foot special management zone without prior consultation and approval of the Sitka Planning Department.

- the cutting or eradication of natural vegetation occurring within the special management zone which would cause losses of stream side and lakeshore cover, losses of desirable wetland vegetation, erosion of soils into adjacent waterbodies, or losses of the natural capacity of the shoreland vegetation to provide filtration and buffering to the waterbody from adjacent land uses;

- disposal into the lake, wetlands, streams, or special management zone of snow collected from streets, thoroughfares, parking lots, or driveways within the city;

Proper uses germane to lake rehabilitation and effective stormwater management include:

- construction of property improvements which do not infringe on wetlands areas nor result

in runoff of polluted water into the aquatic system;

- habitat enhancement projects for the purpose of improving fish and wildlife populations within the AMSA and surrounding areas;

- scientific research and instruction where compatible with fisheries and waterfowl management goals;

- planting of trees, shrubs, gardens and lawns, . . . and other property improvements which do not create additional impermeable surfaces, destroy wetlands, nor result in runoff of polluted water into adjacent aquatic systems.

Clearly, the above uses and objectives provide a solid "target" or foundation for lake restoration in general and for developing a stormwater management program.

3. Goal and Objectives for Stormwater Management in the Swan Lake Watershed

The goal and objectives for the Swan Lake Stormwater Control Strategy are consistent with the management objectives for the preceding *Swan Lake AMSA* and *Swan Lake Watershed Recovery Strategy.*

The *goal* of the Swan Lake Stormwater Control Strategy is:

"Manage stormwater quantity and quality to ensure efficient drainage and the reduction of pollutants entering Swan Lake and its tributaries"

Eight (8) *objectives* support this goal. Each are measurable, so that levels of success can be evaluated. Objectives were selected to address each of the six EPA program elements considered to be essential components of an approvable stormwater management plan. Tasks supporting each objective are described in the Action Plan found in a later section.

Objective 1: *Maximize use of natural vegetated swales and wetlands to store and treat stormwater runoff.*

Objective 2: *Substantively involve watershed residents as participants in keeping their watershed clean and in reporting illicit activities.*

Objective 3: *Use a series of structural and non-structural best management practices to actively manage stormwater runoff, including experimental and innovative approaches.*

Objective 4: *Institutionalize CBS operation and maintenance practices and stormwater controls through written procedures and employee education and training.*

Objective 5: *Monitor stormwater quality over time to evaluate effectiveness of controls.*

Objective 6*: Educate developers and residents on best management practices to maintain high water quality in stormwater runoff to the lake.*

Objective 7: *Use the Swan Lake Stormwater Control Strategy as a blueprint for any future municipal-wide approach to managing stormwater runoff.*

Objective 8: *Recognize the strong interrelationship between stormwater quantity and stormwater quality in managing stormwater runoff.*

II. THE PHYSICAL SETTING

Land uses, climate and conditions in the Swan Lake watershed are summarized in this section. A complete description of the history and management efforts to address lake water quality can be found in the following two documents: *Swan Lake Watershed Recovery Strategy. Phase 1: Debris and Solid Waste Removal and Control (January 2000)* and the *Swan Lake Watershed Recovery Strategy. Phase 2: Eutrophication Report and Action Plan (June 2000).*

Climate

Sitka has a maritime climate with frequent and heavy precipitation. Low-lying fog, overcast skies, rain and drizzle dominate weather conditions. Episodic events of extremely heavy rainfall (in excess of 2.5 inches per day) can occur during September and October. Average annual precipitation is about 86 inches, some of which falls as snow. Normal summer air temperatures range from 50 degrees Fahrenheit (F) to 60 degrees F while normal winter air temperatures range from 31 to 39 degrees F (National Weather Service, 1999). Prevailing summer winds are from the south and southeast and from the southeast in fall. Monthly average wind speeds range from 3 to 6 mph.

Physical Morphology and Land Use

Swan Lake is a small (23 acre), shallow lake located within the City and Borough of Sitka (*Figure 1*). It is a sunken bog, with bottom peat deposits ranging from five to seventeen feet thick. The lake has a maximum depth of about 11.5 feet. Roughly 48 % of the lake is less than 3 feet deep with an average depth of 4.5 feet. Shoreline length is estimated at 6,600 ft. Approximately 60% of the lake shoreline is inhabited. The lake freezes in winter to an ice thickness of up to 12 inches. The entire Swan Lake watershed is small, approximately 2 square miles in size, and drains to the lake principally through two major streams, Wrinkleneck Creek and Arrowhead Creek.

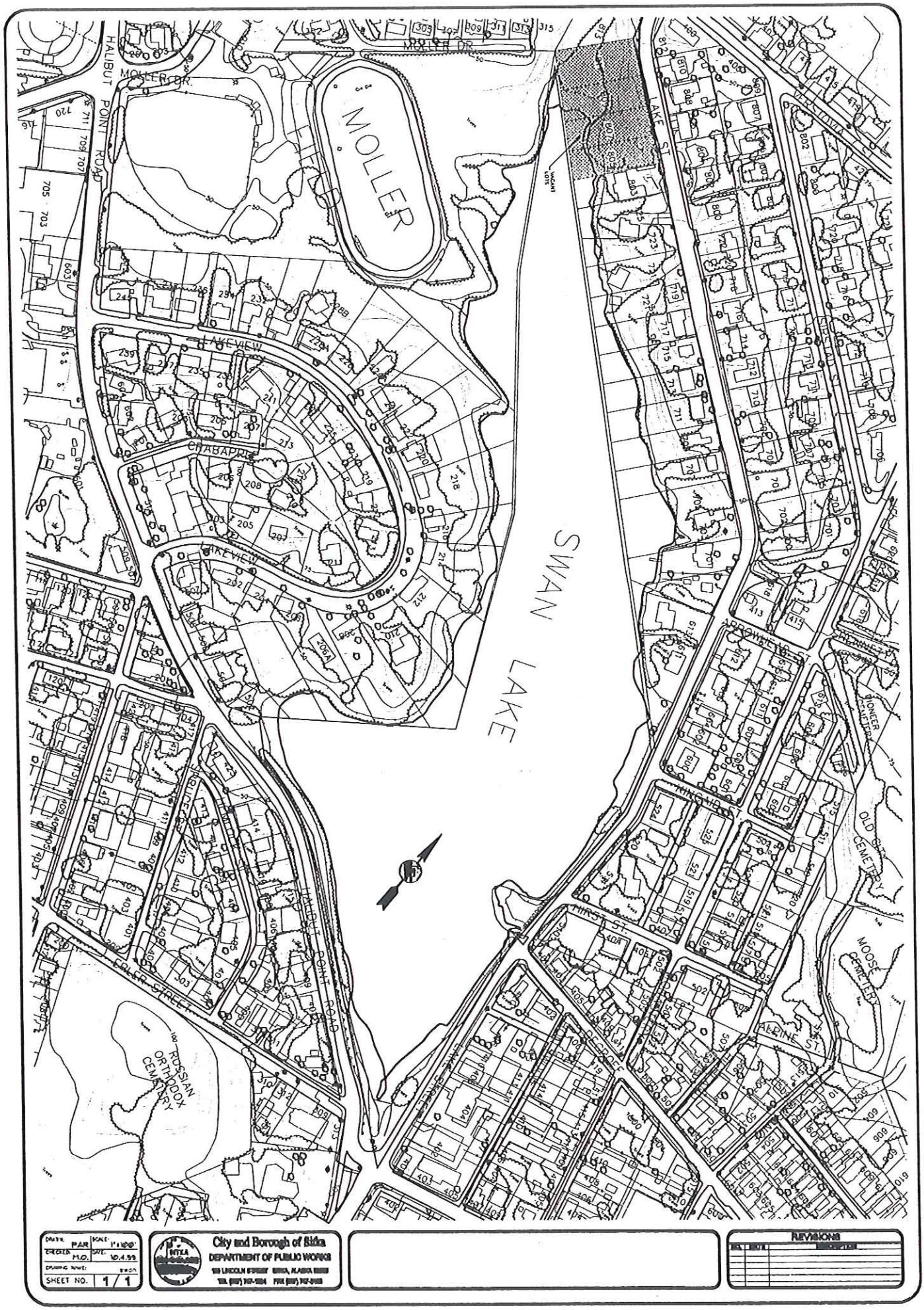


Figure 1. Swan Lake, Sitka, Alaska

The lake is a popular recreation area for Sitkans and is the centerpiece of the Swan Lake Area Meriting Special Attention (AMSA) established in 1981. Like many older, shallow lakes in glaciated areas, it suffers from such symptoms as overabundant aquatic plants, rich organic deposits, periodic depression in dissolved oxygen levels and restricted access for recreational boating and fishing. The natural succession of the Swan Lake plant community towards a higher density is enhanced by eutrophication - an increase in nutrient content of the water and sediments as a consequence of human activities. Left unchecked, the lake will eventually fill up with organic material, turning the lake into a swamp and, ultimately, into terrestrial habitat.

Swan Lake has low water clarity. This is naturally occurring. The muskeg soils drained from the upper reaches of the watershed add tannins that naturally color the water and reduce visibility.

The outlet of the lake flows into Sitka Sound adjacent to the Library through a 60 inch (5 foot) diameter culvert, 1,200 feet in length.

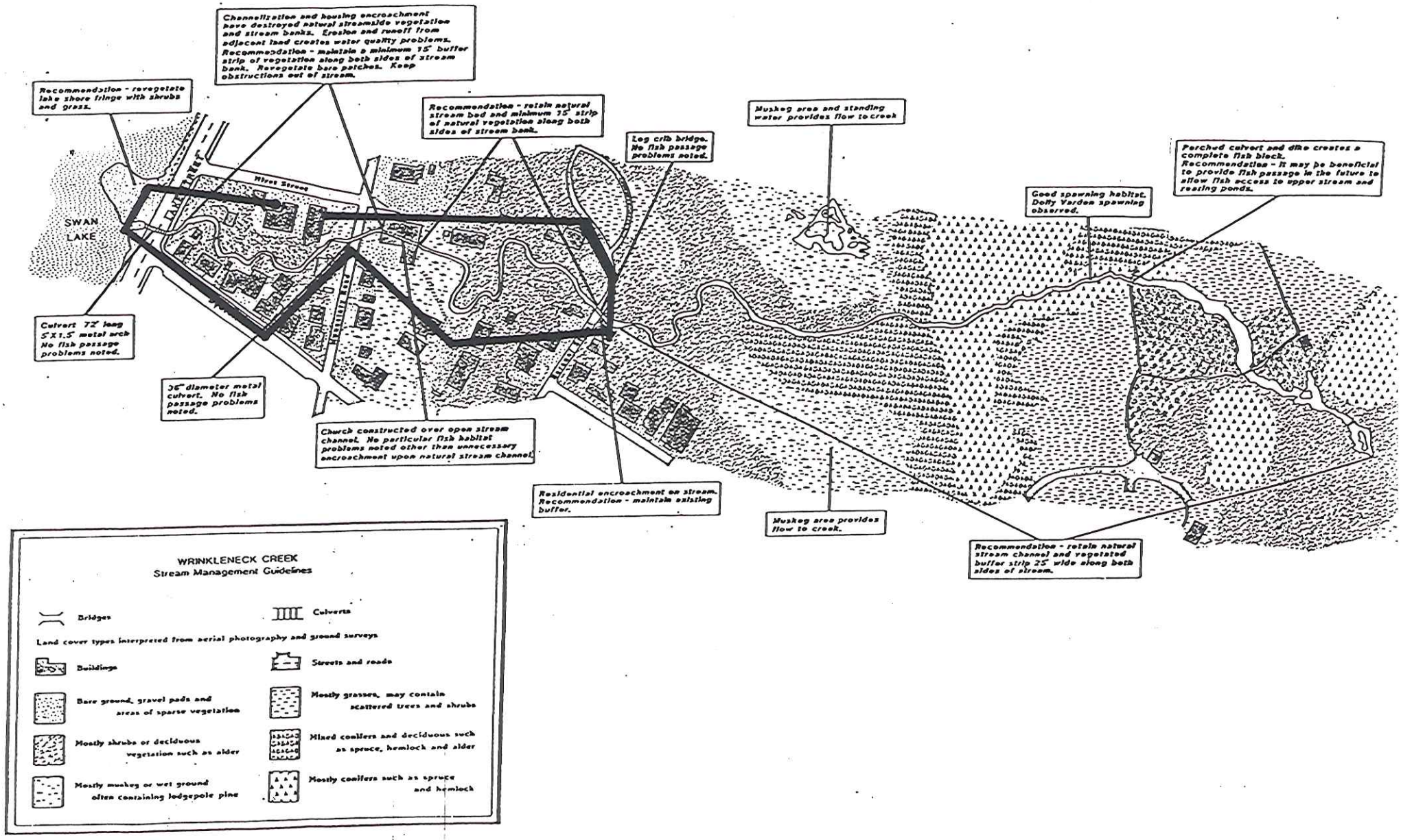
Swan Lake is bordered on the east by Lake Street and on the west by Halibut Point Road and the Lakeview Subdivision. Moller Park abuts the northwest end of the lake. Upwards of 100 homes surround Swan Lake and the two tributaries. Land ownership in the watershed is a mix of private, municipal, state and federal. Development around Swan Lake was accelerated by urban renewal projects in the 1960's, which included installing a sanitary sewer collection system, city water, paving of streets, a 1200 ft. outlet culvert and a stormwater drainage system.

Two feeder streams to Swan Lake - Wrinkleneck Creek and Arrowhead Creek - and contiguous marshlands around the lake, are included within the Area Meriting Special Attention (AMSA) adopted in 1981. Wrinkleneck Creek is the major tributary entering the lake and receives considerable residential runoff. It originates in a muskeg area approximately 3,000 feet east of Swan Lake and traverses muskeg bogs and spruce/hemlock forest along its upper reaches. The lower 1,000 feet winds through a residential area between Baranof Street and Lake Street before discharging to Swan Lake (*Figure 2*).

Arrowhead Creek is approximately 700 feet long, also originating in a muskeg/bog area east of the lake. Arrowhead Creek enters the northeastern end of Swan Lake. It is flanked by residences up to its headwaters. It receives drainage from the high school and residences in higher elevations on the north and east side of Swan Lake. The Arrowhead Cr/Monastery Street intersection serves as a major collection point for stormwater runoff.

Wrinkleneck Creek is a low gradient, shallow meandering watercourse fed by surface runoff and groundwater sources in its headwaters. The creek remains unfrozen during winter months, with estimated peak flows of about 25 cubic feet/second (cfs) during fall. The hydrology of both Wrinkleneck and Arrowhead Creeks is driven principally by precipitation and surface water runoff during fall when adjoining wetlands and soils are saturated, with a relatively higher contribution from groundwater expected during winter and any extended summer dry periods (Paustian, personal communication). Given the subsurface geology of the area, it is difficult to quantify the

Figure 2. Wrinkleneck Creek Stream Management Map, with area requiring concentrated debris/solid waste cleanup noted within black lines (original map from ADF&G, 1981).



relative contribution of groundwater to Swan Lake's hydrology. It is certainly relevant, particularly groundwater discharges to the headwaters of the creeks.

Both Wrinkleneck and Arrowhead Creeks have been significantly altered by stream channelization and obstructions, culverting, and filling of adjacent wetlands and flood plains.

III. SOURCES AND PATHWAYS OF STORMWATER RUNOFF IN THE SWAN LAKE WATERSHED

Stormwater runoff to Swan Lake and its tributaries comes from several sources. Stormwater is collected and transported by a diverse combination of roadside drainage ditches, culverts, catch basins and underground drainage, and the two creeks. Direct runoff occurs from 1) Halibut Point Road on the west side of Swan Lake, 2) Lake Street on the east side of the lake, and from 3) residential and construction sites in the lower watershed. Other sources include winter snow maintenance and runoff from a variety of parking lots, residential side streets, vacant lots, and other impervious surfaces within the watershed. Each of these sources is briefly discussed below. Vegetated, riparian areas of variable width are generally in place adjacent to both Wrinkleneck Creek and Arrowhead Creeks, and when retained, serve as effective sediment, oil and pollutant filters for stormwater runoff before it enters the streams.

Existing Stormwater Discharges and Sources in the Swan Lake Watershed

In September 1999, all stormwater outfalls discharging to Swan Lake were inventoried and mapped (Redburn Environmental & Regulatory Services, 2000). *Figure 3* shows the location of the more than 20 stormwater outfalls discharging to Swan Lake. *Table 1* summarizes the street location, diameter, estimated flow, and description for each outfall. Twenty separate outfalls are located on the Lake Street Side; three majors and six total outfalls are located on the Halibut Point Road side. Several outfalls are no longer functional due to subsidence below the lake surface or from being clogged with sediments.

Stormwater outfalls vary in size and type from 12 inches to 42 inches in diameter. Some stormwater outfalls discharging from Lake Street are submerged below the water surface of Swan Lake due to the progressive settling of Lake Street and rising lake stage. While not critical, these outfalls are not carrying water at peak efficiency. Many outfalls around the lake discharge shoreward of the sedge grasses, which trap discharged sediments.

The Department of Transportation and Public Facilities (DOT&PF) installed a new underground storm drainage system on Halibut Point Road in 1996, including several Type B catchment sumps for sediments (*Figure 4*). One oil/water separator is installed at the main, southern-most drain (Sundberg, personal communication). Cleaning out the sediment catch sumps on Halibut Point Road is done by the CBS Public Works Department on an as-needed basis (typically twice per year) through a cooperative agreement with ADOT&PF. Lake Street also has storm drain

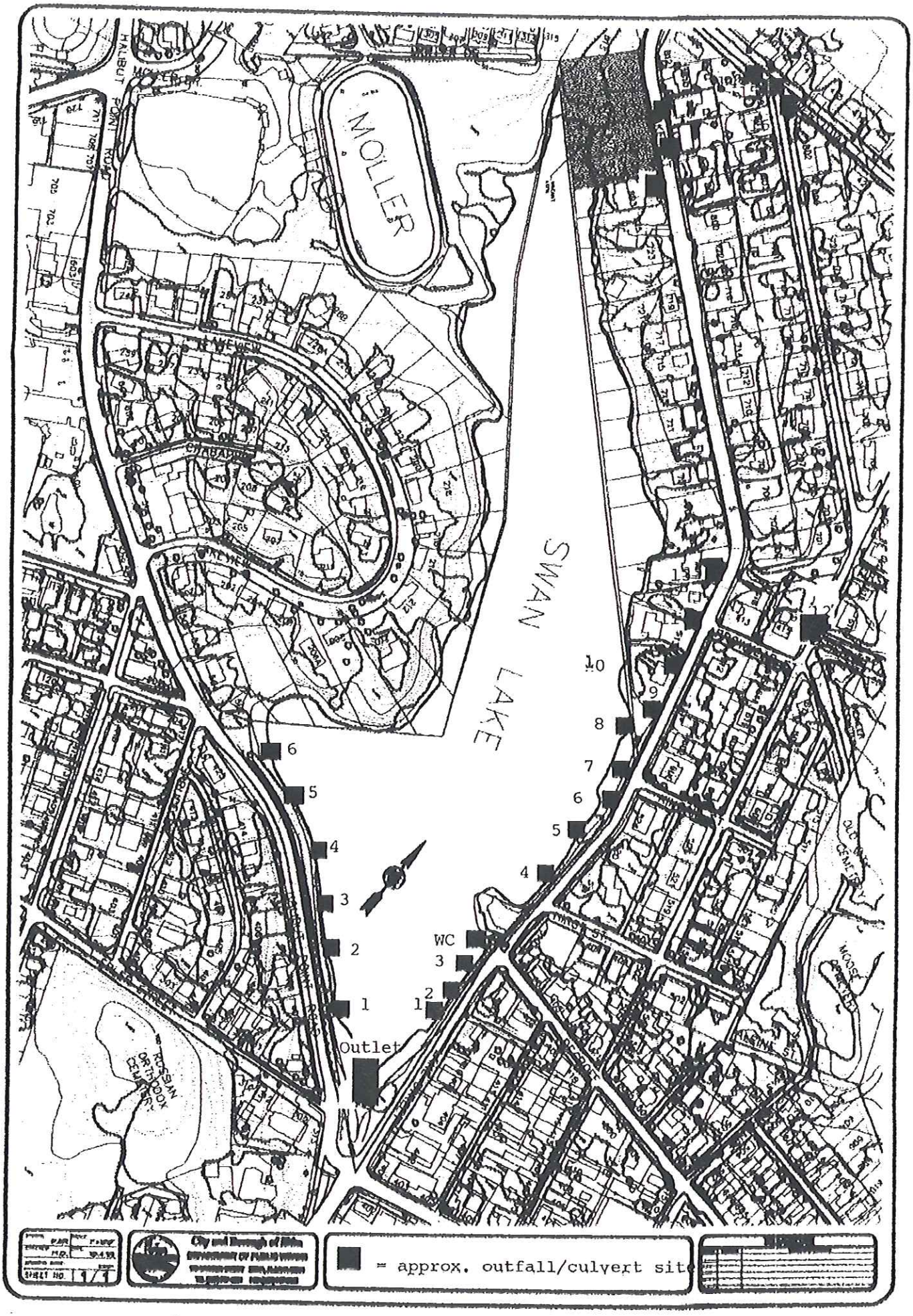


Figure 3 : Stormwater outfalls and major culverts, Swan Lake
(see Table for description of individual outfalls)

Table 1. Swan Lake Stormwater Outfall and Culvert Inventory, September 22, 1999

	DIAMETER/TYPE	FLOW/STATE	STREET LOCATION	DESCRIPTION
HALIBUT PT RD				
Outlet Structure	11 ft squashed culvert	2.3 ft/sec	Intersection of Halibut Pt. Rd and Lake Street	Sediment/vegetative growth in outlet channel
Stormwater outfall 1 (15 ft north of outlet)	24"	5" water depth; 1/3 full	15 ft north of outlet structure	Main stormwater discharge point; cloudy water
Outfall #2	18"	low flow	North of outfall #1.	Underwater; discharge to grasses
Outfall #3	18"	low	North of outfall #2	Not well maintained; gravel/sediment
Outfall #4	Connects to drain		North of outfall #3	Flows south to discharge outfall #1
Outfall #5	Connects to drain		North of outfall #4	Connects to discharge @outfall 1
Outfall #6	18"	Larger drainage basin served	Across from 423 Hal. Pt Rd (Dentist's Office)t	Discharge to west cove grasses; Marine St. runoff through this outfall

LAKE STREET				
Outfall #1	12"	1 1/2" water	Orange arrows	100 ft north of Senior Home
Outfall #2	12"	submerged in lake	DeGroff; occassional backups	submerged outfall (lake rise estimated 6"-8 " since 1960's)
Outfall #3	12"	½ full to full	" "	
Wrinkleneck Creek	74" arch	95% full; 2.83 ft/sec estimated flow	Mouth of creek	Shallow delta; 18" water backup on lake side of dischrge Dredge channel?
Outfall #4	12"	3" water, flowing	State Farm office	
Outfall #5	12"	11" water, flowing	South of Kincaid St.	Sediment buildup; dug out by Public Works
Outfall #6 (orange marking)	12" PVC	10" water, stagnant	Kincaid Street	
Outfall #7 (orange arrows)	12"	8" water, flowing 0.57 cubic ft/sec estimate	Drains Monastery & Kincaid Streets	
Outfall #8 (orange arrows)	12"	6" water, stagnant	Just north of Kincaid	
Outfall #9	18"	3" water		needs maintenance
Outfall #10	12"	stagnant, 7" buried below pond level	KIFW site; ties to outfall #9 to flow south	submerged culvert; obstructed by grass
Arrowhead Creek (Outfall #11)	40"	13" water on uphill side, 3" water on lake side(Miller's)		10" water drop in flow to Swan Lake; vegetation removal on uphill side?
MONASTERY ST (main)	40"	23 ½ " water uphil side; 1.1 ft/sec veloc	Uphill side of street	Water level 6 ½ " higher on downgradient end of culvert; historical flooding
Outfall #12	40"	30" water at pond outlet	Down-gradient at pond	
Outfall #13	18"	5 ½ " water, fast flow to pond		Muck out pond
VERSTOVIA/SIR STAD INTERSECT.				
Outfall #14	12"	½ " water; slow flow		Receives High School drainage
Outfall #15	24"	1" water; good flow		All three (3) drain to Swan Lake, not Arrowhead Cr.
Outfall #16	18"	3 ft/sec velocity		

LAKE STREET (NE CLUSTER)				
Outfall #17	8"			
Outfall #18	8"		By Coca-Cola House	
Outfall #19	70" squashed culvert 42" on Lake St side	36" water in culvert on uphill side; 4 " water in culvert at lake end	Drains Monastery St to Swan Lake (by Meechum's)	Receives drainage from outfalls 14/15/16 (High School area); skunk cabbage, steep; clear out vegetation & sediment
Outfall #20	18"	½ " water; little flow		Muck out Lake side

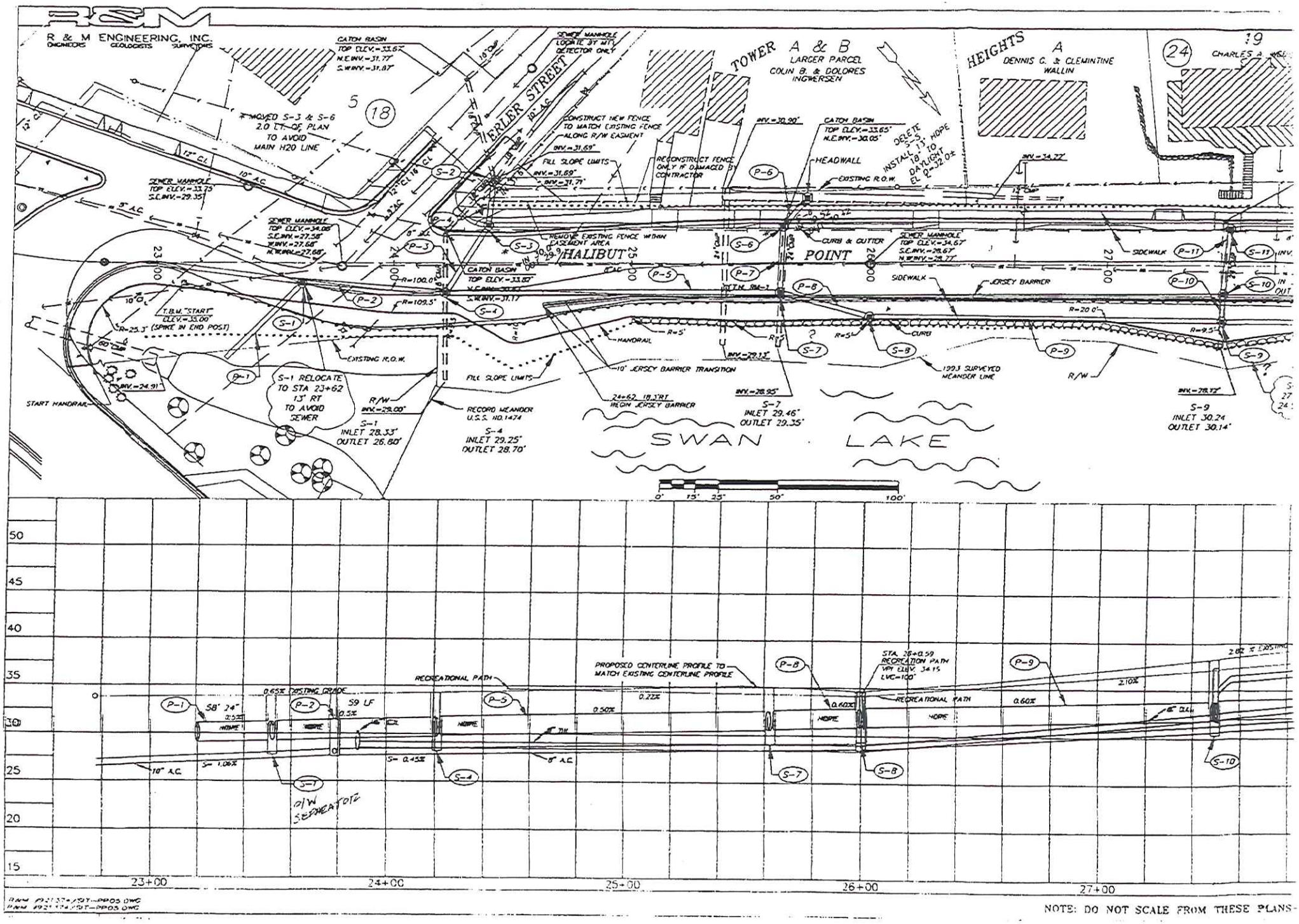


Figure . Halibut Point Road Stormwater Drainage and Road Improvements (ADOT&PF, 1999)

sediment traps, with the bottom of the catchment basins located 8 to 12 inches below the culvert bottom to trap sediments (Brian Bergman, personal communication). Sediment traps are cleaned semi-annually by municipal staff using a suction hose called a "camel". Accumulated sediments adjacent to Lake Street and along the east shore of the lake are removed annually using backhoes. The lakeside sedge grasses act as a natural berm or barrier to the transport of sediment to deeper portions of Swan Lake. Retaining these natural swales is important for trapping roadside sediments along the lake shore.

The volume of stormwater runoff is a function of precipitation. Sitka receives an average of 86 inches of rain annually. Controlling the volume of stormwater runoff is important and must be managed along with stormwater quality. The 1999 stormwater outfall survey coincided with a heavy rain event. Lake stage was high as flow into the lake exceeded flow out of the lake. This event offered the opportunity to examine the relative discharge efficiency of the stormwater outfalls and creeks during a minor flooding event and to evaluate problems. Localized flooding of the uphill drainage ditch on Monastery Street required cleaning out the next day. The Arrowhead Creek/Monastery intersection, and residences on the uphill side of the street, typically can be a problematic site for flooding, with two homes in this area having experiencing periodic flooding during the fall. These sits have received considerable attention in an effort to moderate high flows and flooding.

The Monastery Street/Arrowhead Creek location has been evaluated several times recently by the CBS and the Swan Lake watershed team with the intent of making drainage improvements. The range of options examined and discussed include installing a 70 ft length of new culvert to be attached to the Lake Street culvert, replacing the current Monastery Street culvert with a larger diameter culvert (or alternately, installing a second culvert), improving the hydraulic efficiency of the existing culvert intakes and continuing to maintain the existing sedimentation pond. Installing hydraulic wings and/or finer grid trash screens over the creek outlet culverts to minimize blockage of culverts with large wood and debris was also considered. While expensive, eventual replacement/ and possible rerouting of the entire Lake Street culvert is a long term objective of the CBS. The grade is suboptimal for this culvert, with a drop in hydraulic efficiency during high flows. Drainage problems in the backstreets are felt largely due to the lack of grade in the Arrowhead Creek/Lake Street culvert passing under Lake Street.

In April 2002, the US Forest Service completed a hydraulic analysis and survey of the area and recommended two options to improve stormwater drainage efficiency and reduce flooding risk in the Monastery Street area: 1) install a wing wall/apron inlet structure on the inlet of the Lake Street culvert and a headwall inlet (culvert barrel should be cut flush to the road sub-grade) at the Monastery Street culvert; or 2) replace the current 42" steel culvert at Monastery St. with a 60" x 46" aluminum pipe-arch structure. Diverting some stormwater drainage away from the Monastery St. intersection would also reduce flood potential. Continued routine maintenance dredging of the settling pond on the Arrowhead Creek section between Lake Street and Monastery Street is recommended. Such a program reduces sediment input to the lake and increases stormwater storage capacity.

Stormwater runoff occurs from residential and low-density commercial development along the lower and mid-segments of Wrinkleneck Creek and from residences around the lake. Debris and solid waste, residential above-ground home heating oil tanks, fertilizer/nutrients from lawns, driveway and spur roads, and sanitary sewer connections are sources specifically targeted for attention in the *Swan Lake Watershed Recovery Strategy* completed in January 2000. Annual community debris and solid waste cleanups, homeowner checks of above-ground tank connections, and a homeowner guidebook of best management practices to protect water quality are products that have been completed to address these stormwater sources. These activities are described in more detail in the section on *Current Stormwater Controls and Management Practices.*

Winter road maintenance and runoff affects water quality in Swan Lake and its tributaries. Gravel, sand and deicing chemicals are added to the roads during winter and eventually find their way to Swan Lake. A variety of deicing chemicals are applied. The CBS uses a mix of 90% sodium chloride salts with 10% magnesium on Lake Street - a product called CG90 (Brian Bergman, personal communication). The State Department of Transportation and Public Facilities uses magnesium chloride on Halibut Point Road. Sand and gravel are principally used on the municipal back streets, with few chemicals applied. Snow is plowed on Lake Street directly to the side of Swan Lake, with some snow stockpiling occurring at the radio station lot.

There are no inflow and infiltration (I & I) problems concerning stormwater since the CBS does not have combined sewer/stormwater system. All I & I issues are related to the sanitary sewer system and are not part of the Swan Lake Stormwater Control Strategy.

Drainage Pathways of Stormwater Runoff in the Swan Lake Watershed

Documenting the drainage patterns - or pathways - of stormwater runoff is an important aspect of managing its quality. Having intersection-to-intersection flow details allows managers to answer questions such as: "If a quart of Pennzoil is spilled down a storm drain at Site X, can I work back from the lake and reliably find its source?" Tracking illicit discharges is only one of many benefits of mapping stormwater flow within "subunits" of a watershed. Others benefits include managing the volume of stormwater flow, providing information for analyzing the effects of runoff from future growth in the Swan Lake watershed, and directing site-specific water quality monitoring to discriminate between different sources of stormwater entering Swan Lake and its tributaries.

Figure 5 documents the source and direction of stormwater flow in the Swan Lake watershed on a street-by-street basis. It is the culmination of on-the-ground inventory efforts of CBS Public Works and Engineering staff and the project contractor. The *Appendix* includes a map with catch basins and culverts shown along with streets and residence addresses.

Potential Future Stormwater Sources

New land clearing and future development in the upper portions of the Swan Lake watershed will contribute some sediments and other runoff to Swan Lake. Proper design of stormwater collection points and maintenance will be important to reduce this loading. Future developments slated for the upper Swan Lake watershed would be subject to federal and state permitting and oversight of stormwater runoff.

A proposal for a new athletic field adjacent to Sitka High School is being currently evaluated for its environmental effects, including stormwater runoff into the Swan Lake watershed and/or Turnaround Creek. The proposed athletic field is Phase I of the CBS' Conceptual Master Plan for a multi-phased recreational complex at the high school, to be followed by a running track, baseball/softball fields, nature trail and student study area.

The draft Environmental Analysis (EA) for the combined recreational complex indicates that construction may cause additional stormwater runoff to enter Swan Lake through two drainage pathways. A third pathway would affect Turnaround Creek in the watershed north of Swan Lake. Clearing of the site would involve roughly 4.5 acres, and construction would require erosion controls to avoid loss of soils and sediments from disturbed sites. One possible pathway drains from the new parking lot, under Verstovia St, through several culverts near residences along the 800 block of Lake Street, crossing under Lake Street to discharge into the North end of the lake through Outfall #19 (see *Figure 3*).

The second drainage pathway is fed from the muskeg/hill area that is the site of the proposed athletic field and winds it's way through a culvert under "A" Street, along Monastery and Sirstad Streets, then to First Street detention pond area in Arrowhead Creek before discharging through the 30 inch culvert under Lake Street that exists by the Miller property.

The clearing of the athletic field would expose a large surface area to significant precipitation and greater stormwater runoff. This could cause greater surge flows running off into the two drainage pathways.

The effects of several potential stormwater runoff pathways are being evaluated in the EA. Options under consideration include diverting the collected stormwater from the development site to the watershed adjacent to the High School on its north side. While effective in keeping stormwater out of the Swan Lake watershed, it could impact Turnaround Creek (an anadromous fish stream) that drains to Sitka Channel near Thomsen Harbor. Small drainages from and around the proposed construction site flow toward this creek (Clare, 2002). Alternative designs that route drainage away from Turnaround Creek will need to consider appropriate controls to protect Swan Lake's water quality.

The "pros and cons" of each option will be carefully weighed through the review process. In all cases, capturing and treating sediments and polluted runoff prior to entry into creeks and the lake

will be required. Both a Corps of Engineers Section 404 permit and an EPA General Stormwater NPDES permit for Construction Activities will be required. These will include pollution control and habitat protection stipulations.

IV. WATER QUALITY CONDITIONS IN THE SWAN LAKE WATERSHED

Long term water quality monitoring is essential to evaluating trends over time and the effects of stormwater runoff. Several water quality surveys have been completed for the Swan Lake watershed since 1999 as part of the *Swan Lake Watershed Recovery Strategy.* Historical water quality data from the 1970's and 1980's are also summarized below. With the recent approval of the Swan Lake Quality Assurance Project Plan (QAPP) to guide citizen and agency water quality monitoring in the watershed, additional long term information will be available for several water quality parameters.

While most available water quality data are from Swan Lake and Wrinkleneck Creek, some data also exists for major stormwater outfalls discharging to Swan Lake. The lake is the "watershed endpoint or integrator" and assessing conditions in the lake allows one to make important conclusions about the quality of stormwater in the watershed before it enters the lake.

1. Water Quality Monitoring Results (1970s through 2000)

The earliest reported water quality monitoring in Swan Lake was completed by the Department of Fish and Game's Sport Fish Division in the mid to late- 1960's. This period coincided with municipal urban renewal efforts (paving, sewer system installation, new outlet structure) and ADF&G's subsequent plans to treat the lake with rotenone and stock with rainbow trout. Some dissolved oxygen data were collected during winter to access the viability of stocking rainbows and/or cutthroat trout. Three stations were established with varying depths (2 feet, 6 feet and 11 feet) during winter 1969. Data are reported for both January 1969 and January 1970 from the deepest station at the south end of Swan Lake (ADF&G, 1970). Dissolved oxygen concentrations reported in winter 1970 were 9.3 mg/liter at 1 ft below the ice and 4.9 mg/l at 10 ft; 1969 concentrations at the same site were 9.3 mg/ at 1 ft. depth and 4.0 mg/l at 8 ft. depths (2 feet above the bottom). A winter pH reading of 6.3 units was recorded. These data were used to conclude that, while some bottom water values are depressed during winter, the dissolved oxygen levels in the lake would support stocked populations of rainbow trout.

In 1979, the Sport Fish Division completed limnological surveys of Swan Lake as part of a survey of several small lakes in Southeast Alaska. The lake was sampled every third week from May through August. Data were collected on lake morphology, physical and chemical characteristics, plankton, bottom fauna and fish populations. Temperature, Secchi depths (transparency), pH, dissolved oxygen, hardness, alkalinity, ionic composition and nitrate and ortho-phosphate concentrations were reported (*see Appendix*). In summary, nutrient levels in the water column were not elevated, zooplankton biomass was typical of alpine or oligotrophic lakes rather than

eutrophic lakes, and dissolved oxygen profiles typically ranged from 9 mg/l at the surface, 7 mg/l at depths of five feet and 1 to 3 mg/l at the lake bottom. The specific conductance of 83 umhos for Swan Lake was the second highest studied to that date in Southeast Alaska and was attributed largely to the sodium and sulfate probably from domestic pollution (ADF&G, 1979).

The Alaska Department of Environmental Conservation (ADEC) completed comprehensive trace metal and pesticide analyses of sediments collected from Swan Lake and Wrinkleneck Creek in 1983, 1984, 1989 and 1991. Some fecal coliform bacteria samples were also collected. The laboratory results showed pesticide and PCB concentrations in lake sediments to be below the level of detection and sediment trace metals to be within acceptable sediment quality guidelines. The Appendix includes results from the 1984 metals and pesticide survey. ADEC does not currently have numeric sediment criteria for metals in its water quality standards, only regulatory criteria for water concentrations of metals. ADEC-measured fecal coliform bacteria levels in the lake ranged from a maximum of 57 colonies/100 milliliter (ml) to 0 colonies/100 ml.

ADEC completed on-site water quality investigations of the Swan Lake watershed in October 1996 and April 1997 subsequent to the 1994 listing of portions of the watershed on the state's impaired waterbody list for debris and solid wastes. Redburn Environmental & Regulatory Services, as contractor to the CBS, completed a third survey in September 1999 as part of the Swan Lake restoration project. The findings and conclusions are described in detail in the January 2000 report *Swan Lake Watershed Recovery Strategy. Phase 1: Debris and Solid Waste Removal and Control* (CBS/Redburn, 2000). Turbidity levels of the two feeder creeks and Swan Lake were low and within standards (less than 5 NTUs above natural condition), coloration (which doesn't affect turbidity) was high due to muskeg tannins, and settleable solids levels at the Lake Street culverts discharging Arrowhead and Wrinkleneck Creeks were below the detection limit (less than 0.2 ml/l). Settleable solids concentrations from stormwater outfall discharges were not measured but a visible plume at several outfalls was observed during the September 22, 1999 storm event (2.7 inches of rain). No oil sheens were observed. These screening data suggest that wetland vegetation within the creek buffers is effective at filtering out heavy sediments during high rain events. Available funds were not sufficient for nutrient screening.

For screening purposes, dissolved oxygen concentrations, temperature, lake depth and Secchi depth were measured at twelve stations on Swan Lake on September 24, 1999. Conductivity was measured at selected stations and at the mouth of Wrinkleneck Creek. Surface and bottom water DO measurements were taken from each station. *Table 2* summarizes the results of the September 1999 screening survey.

Various school project monitoring and fisheries investigations in Swan Lake and Wrinkleneck Creek since 1994 (Kent Bovee high school classes and Cal Hayashi middle school classes) have provided some citizen-generated water quality information about the lake and Wrinkleneck Creek. These surveys are a good teaching tool for students and provide useful information to help manage the lake and watershed. Parameters measured include pH, dissolved oxygen, conductivity, turbidity, temperature, invertebrates, and rainbow trout and sticklebacks. Student

Table 2 . Swan Lake Water Quality Conditions, September 24, 1999

Lake Station #	Dissolved oxygen (mg/l) Surf	Bottom	Sed	Depth (Ft)	Secchi Depth (Ft)	Temperature (C) Surf/bottom	Conductivity (umhos/cm)
1	7.20	6.05		3.5	2.0	10.8/10.6	-
2	8.44	7.66		6.0	2.5	10.9/10.6	-
3	8.34	8.37	1.5	10.1	2.5	10.7/9.8	700/700 (replicates)
4	8.30	9.10		5.0	2.5	10.7/9.7	600
5	8.28	7.20		7.5	2.75	10.5/9.8	-
6	8.28	8.25		2.0	To bottom	10.6/10.6	600
7	7.50	6.28		2.0	To bottom	10.7/10.5	-
8	8.20	7.10	1.10	6.2	2.5	10.7/10.5	-
9	8.40	8.38	0.60	9.0	2.75	10.8/9.9	-
10	7.35	7.50	1.77	7.0	2.5	11.2/10.3	-
11	7.90	8.00		6.5	2.5	11.1/9.5	600
12	-			-	3.0	-	-
Wrinkleneck Cr. mouth	-			-	-	-	350/350
Arrowhead Cr. (Monast. St)	-			-	-	-	300/300

water quality data collected since fall 2001 are guided by the approved Swan Lake QAPP and will be entered into a database that can be broadly shared with Sitka residents and others.

Prior to 2001, the only available nutrient data for Swan Lake were collected from the 1979 ADF&G surveys. Mean ortho-phosphate, nitrate and nitrite concentrations in water were less than 10 ug/liter (0.010 mg/l), less than 100 ug/l (0.100 mg/l), and 20 ug/l (0.20 mg/l), respectively. These levels are not elevated. These levels comport with the relatively low standing stocks of plankton reported in ADF&G's 1979 lake survey. Phosphorus levels greater than 10 ug/liter have been shown to promote blue-green algae growth (Department of Ecology,1999). Sitka High School student monitoring of nutrient concentrations in the lake and Wrinkleneck Creek began in September 2001 and also indicate low levels of phosphates and nitrogen (Kent Bovee, personal communication).

The relationship of stormwater quantity to stormwater quality is clearly important. An old adage says "As the hydrology goes, so go the wetlands". Historically, fill for homes and roads have served to channelize and reduce the flood plains for both Arrowhead and Wrinkleneck Creeks. Reduction and loss in the water-absorbing functions of stream side and lakeside wetlands, coupled with stormwater inputs, have led to a rise in the level of Swan Lake since the mid-1970's. Historical aerial photographs document differences in lake stage over time. A 1929 aerial photograph of Swan Lake shows a considerably lower lake level, with muskegs around the perimeter. More recent open water photographs show a higher lake stage. Coupled with a rising lake stage, Lake Street is estimated to have subsided approximately 6 inches from 1976 to 1985 (Stragier, 1985) and another 6 inches from 1985 to the present (Brian Bergman, personal communication).

Permanent lake elevation benchmarks (a lake staff gage) were installed by the USGS at the lake outlet channel in June 2001 as part of the Swan Lake restoration project. These elevation gages allow for the long-term assessment of lake height fluctuations and road sinking. For example, the gages have confirmed the beneficial effects of deepening the lake outlet channel in June 2001. Peak lake levels have been lowered and fluctuations moderated by the dredging project.

As mentioned above, estimates of flow rate at the Swan Lake outlet and the two inlets streams were made in September 1999 in an effort to estimate a rudimentary water budget for the lake. Flows were calculated using wetted cross-sectional area in culverts multiplied by stream velocity. The USGS has offered to assist in measuring flow rates at the request of the CBS. A professional hydrologic survey is considered an important element of the overall Swan Lake watershed rehabilitation strategy and stormwater control strategy.

2. Stormwater Quality Monitoring Results (2001 to the present)

The two major conveyances of stormwater runoff to Swan Lake are Wrinkleneck Creek and Arrowhead Creek. These creeks receive residential and light commercial runoff prior to discharge into the lake. Both creeks have several established monitoring stations. Three "screening"

surveys of stormwater quality in major outfalls discharging to Swan Lake were completed by the project contractor from October 2001 through April 2002 (*Table 3*). Targeted parameters are turbidity, Total Suspended Sediments (TSS) and settleable solids. Some nutrient data collected by student monitors is expected to be available by summer 2002.

Direct street runoff to the lake from Halibut Point Road and Lake Street are also major stormwater contributors. During high rain events, turbid plumes have been historically observed at the southernmost Halibut Point Road stormwater outfall near the lake outlet. This outfall discharges the majority of water draining off Halibut Point Road. Sediment levels measured in discharges from this outfall immediately after cleaning out the storm catch basins on HPRoad in fall 2001 showed a large reduction in TSS concentration (drop from 46.0 mg/l in October 17, 2001 to 0.5 mg/liter on November 20, 2001).

Table 3. Stormwater quality measured at major inputs to Swan Lake, October -November 2001 and April 2002. [1]

Station	Date	TSS (mg/l)	Turbidity (NTU)	Lake height (ft)/creek ht (inches) [2]	Settleable solids (ml/l)
Swan Lake (Wrinkleneck Cr. delta)	10/16/01	---	6.01, 5.59	27.74 ft	---
Swan Lake outlet channel (SW1) ❶	10/17/01	---	5.48	27.84 ft	---
	11/20/01	---	4.25	27.61 ft	
	4/11/02	---	3.73, 3.66	27.55 ft	
Swan Lake stormwater outfall near lake outlet	10/17/01	46.0	---	27.84 ft	ND; <0.2
	11/20/01	0.5	13.5, 14.1	27.61 ft	
	4/11/02	ND; <0.5	3.12, 3.39	27.55 ft	
Wrinkleneck Creek mouth (WC1) ❶	10/16/01	---	1.73, 1.83	14 ½"	ND; <0.2
	10/17/01	10.0	9.65, 10.1	11 ½"	
	4/11/02		1.70, 1.33	20 "	
Arrowhead Creek culvert (AC1) ❶	10/16/01	---	---		ND; <0.2
	4/11/02	2.0	4.13, 3.50		

❶ These stations represent permanent Swan Lake watershed monitoring stations. Please refer to *"A Guide to Volunteer and Agency Water Quality Monitoring in the Swan Lake Watershed and a Quality Assurance Project Plan (QAPP)"* for details on the parameters and stations (Redburn, 2001).

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[1] These sources are the principle conveyers of stormwater to Swan Lake. While other small outfalls discharge to Swan Lake, they have a relatively lessor effect on lake water quality.

[2] Height as measured from the creek's water surface to a permanent reference bolt.

V. CURRENT STORMWATER CONTROLS AND MANAGEMENT PRACTICES

This section assesses current CBS stormwater management controls and practices against federal regulations and criteria. The assessment is made against the 6 minimum elements in the EPA phase II regulations, recognizing that these are strictly guidelines at present pending a decision by EPA on whether Sitka is subject to the regulations. *Table 4* identifies program elements that are adequately addressed, partially addressed, or not addressed. A Stormwater Action Plan for 2000 through 2006 follows the adequacy assessment.

BEST MANAGEMENT PRACTICES AND STRUCTURAL IMPROVEMENTS

A number of activities and practices are currently taken by the CBS to improve stormwater quality in the Swan Lake watershed. These include routine best management practices, drainage improvements, monitoring, cleaning and maintenance of storm drains and culverts, public education and waste oil and antifreeze collection.

A summary of important existing controls is listed below.

- Drainage improvements (channel dredging) at the lake outlet
- Characterizing the quality of stormwater and creek discharges to Swan Lake
- Utilize landscaping areas (lawns, medians,etc) as stormwater treatment areas
- Retention of riparian vegetation within the Swan Lake AMSA buffers
- Distribution of best management practices brochures to homeowners
- Verifying culvert throughput/absence of blockage/finer grid trash screens
- Drainage improvements at the Arrowhead Creek /Monastery Street crossing
- Channel/flow improvements at Wrinkleneck Creek delta at Swan Lake
- Waste oil and hazardous wastes collection facilities maintained by CBS
- Citizen stewardship and education, including BMP brochures and website postings
- Demonstration Projects - school projects on stormwater quality
- Sediment controls and storm drain sump cleanouts and maintenance
- Limit use of high-phosphorus fertilizers; BMPs for disposal of lawn clippings/waste
- Periodic monitoring of fecal coliform levels in Swan Lake
- Use of an interdisciplinary watershed field team to address stormwater issues
- Grading and filling permit required for new developments by Building Department

A thorough discussion of the most important, or successful, stormwater controls, practices and authorities follows.

1. Monitoring Water Quality in Creeks, Lake and Major Stormwater Outfalls

Routine water quality monitoring in Swan Lake, Wrinkleneck Creek and Arrowhead Creek began in 2000. The approved *Quality Assurance Project Plan for the Swan Lake Citizen Water Quality Monitoring Project* guides both student and professional staff monitoring into the future.

Stormwater quality is included as part of this plan. Targetted parameters include dissolved oxygen, sediments, lake height, fecal coliform bacteria, turbidity, flow rate, pH and water temperature. The reader is refered to the QAPP for a full discussion of objectives, stations, and data management. This ongoing program has provided valuable data on the quality of stormwater runoff affecting Swan Lake.

2. Inventory of Stormwater System and Drainage Patterns

The CBS Public Works Engineering Department maintains as-built surveys of all installed sewer lines, stormwater catch basins and conveyances, and water lines. *Figure 5* consolidates stormwater information into a single map that shows directional drainage throughout the Swan Lake watershed on an intersection-by-intersection scale.

A comprehensive inventory of all stormwater outfalls discharging to Swan Lake (see *Figure 3*) was completed in September 1999.

3. Authorities to Control Stormwater Quality

Existing local authorities for controling stormwater are substantial and are summarized in the June 2000 *Swan Lake Watershed Recovery Strategy*. The reader is referred to this document for a full discussion on local ordinances, permits, planning and zoning and other land management tools to regulate stormwater quality. Grading and filling permits and conditional land use permits are key authorizations required for new developments.

4. Reduce Nutrient Loading to Swan Lake

Prior to the mid-1960's, most of the human-induced nutrient loading to Swan Lake was from septic systems within the watershed. That source was effectively eliminated with the installation of the municipal sewer collection system. Some low-level nutrient loading comes from the two creeks and stormwater outfalls discharging to the lake. Algal blooms are not reported in the lake, providing antecdotal information that suggests low to moderate nutrient loads coming into the lake from the stormwater system. Lastly, the CBS has confirmed that urea (a nitrogen product) is not used on Lake Street or other city streets during winter, replaced by sodium chloride (CG90) with a magnesium additive. Magnesium chloride is used on the state highways (i.e. Halibut Point Road).

An undetermined amount of phosphorus and nitrogen continues to enter Swan Lake from residences along the lake shore and feeder creeks. Fertilizers used for lawn maintenance contribute nutrients to the lake. Fertilizers can add nutrients through direct surface runoff or move through the permeable soils into the shallow groundwater table that discharges to the lake. While Swan Lake's hydrology is primarily driven by surface water, groundwater contributes to the water and nutrient budget of the lake. Student monitoring of nutrient levels will provide further information on this issue.

A watershed homeowner education program directed at making people aware of their influence on lake water quality is an effective way to address nutrients, hydrologic alterations that affect the lake, and other themes. The CBS produced *"A Citizen's Guide to Protecting Water Quality in the Swan Lake Watershed"* in June 2001, a brochure listing best management practices, "dos and don'ts" in the watershed, and volunteer opportunities to keep the lake clean. Each resident living along Swan Lake, Wrinkleneck Creek and Arrowhead Creek was mailed a copy.

5. Storm Drain Cleanouts and Drainage Improvements

Sediments in storm drain catch basins along Lake Street, Halibut Point Road, Marine and DeGroff Streets are typically cleaned twice annually by CBS Public Works Maintenance staff. A vacuum cleaner truck - called a "camel"- is used to clean the sumps. This practice usually occurs in the spring and late fall.

A number of drainage improvements along Arrowhead Creek and Wrinkleneck Creek have occurred over the last three years. Continued maintenance work at problematic intersections (Monastery Street) is authorized under Corp of Engineers nationwide permit. Culvert replacement or upgrades may be necessary in the future as funds become available. Improved drainage will result in a reduction in flood potential and will also have a positive effect on stormwater quality entering the lake.

6. Community Watershed Trash and Debris Cleanups

Since 2000, CBS has institutionalized an annual community cleanup of the Swan Lake watershed. The cleanup coincides with the Earth Day weekend in April. This annual event removes trash, debris, metals and leaking containers from throughout the watershed, removes debris blockages to stream flow, and thereby enhances fish habitat and water quality. Community pride in their lake is a spinoff and the results have shown a progressive decline each year in the amount of trash and debris.

7. Interdisciplinary Watershed Field Team

Since 1999, an interagency, and interdisciplinary, watershed team has overseen and assisted the CBS on restoration activities in the Swan Lake watershed. The USGS, ADEC, CBS, ADF&G, Forest Service, Park Service and contractors have worked as a team to address issues on-site. This team should continue to function as an advisory group to the CBS Public Works on the implementation of the *Swan Lake Stormwater Control Strategy*.

VI. ASSESSMENT OF CURRENT STORMWATER CONTROLS AGAINST FEDERAL REGULATIONS AND GUIDANCE

The CBS currently addresses a number of the EPA elements and subelements for an approvable stormwater management plan. Others are either partially addressed or not addressed. *Table 4* assesses the relative degree to which the CBS addresses each of the six regulatory elements of a complete program. These elements are described earlier in the Overview section. The assessment logically leads to the subsequent Action Plan to fill gaps in the current program. Both Continuing and Newly-Proposed tasks are listed as part of the Action Plan.

It is recognized that the EPA stormwater regulations and the preparation of Stormwater management plans are an unfunded federal mandate placed upon municipalities. Costs of preparing and extending a management plan to the entire municipality will be considerable and must await an EPA decision on whether this is mandatory. On the other hand, CBS supports the Swan Lake TMDL and restoration efforts and linking stormwater controls to this ongoing watershed work. For these reasons, this stormwater control strategy is limited to the Swan Lake watershed and the CBS does not wish to extend stormwater costs beyond the Swan Lake watershed at this time.

Table 4. Assessment of current municipal stormwater controls in the Swan Lake Watershed compared against EPA's six elements of an approvable stormwater management plan[3]

Program Element	Adequately Addressed	Partially Addressed	Not Addressed	Comments
*1. **Public education and outreach***				Completed *Swan Lake Watershed Strategy* includes several citizen guides and brochures on keeping the watershed clean. (BMP brochure for homeowners; above-ground fuel tank guidelines, spill reporting.) Wastewater facility stocks multiple types of pollution prevention and watershed protection brochures.
Does the CBS implement a program to distribute educational materials/outreach on reducing pollutants in stormwater?	✔☺			
-steps to reduce pollution?	✔☺			
-disposal of landscape/lawn chemicals and used oil?	✔☺			
- ways to protect riparian vegetation?		✔☺		
*2. **Public involvement & participation***				Annual trash cleanups in the watershed are institutionalized. Student and professional water quality monitoring is ongoing at 8 stations. Pool of watershed residents is formed to assist. CBS website includes watershed info. CBS would benefit from considering a volunteer storm drain stenciling effort. On-site riparian vegetation education and selective wetlands reseeding are also recommended. Citizen involvement in implementing stormwater plan for the watershed is recommended.
Does CBS comply with public notice requirements in soliciting public involvement?	✔☺			
-include the public in the development and implementation of a stormwater control effort?		✔☺		
-monitoring?	✔☺			
- trash management and stream/lake cleanups?	✔☺			
-storm drain stenciling?			✔☹	

[3] These elements are currently not requirements for Sitka. EPA is scheduled to make a final decision by December 2002 on whether communities the size of Sitka are covered under Phase II stormwater rules.

Program Element	Adequately Addressed	Partially Addressed	Not Addressed	Comments
3. Detection/elimination of illegal discharges Has the CBS developed, implemented and enforced a program to detect and eliminate illicit discharges into the stormwater system? -does it address sanitary sewer overflows, if appropriate to the SW system? -include a stormwater system map? -identify non-stormwater discharges into the system? (e.g. water line flushing), - process to ID illicit connections to stormwater system? -citizen reporting of illegal dumps? -inform public of hazards to illegal discharges? -is a stormwater ordinance in place?	✔☺ ✔☺ ✔☺ ✔☺	✔☺ ✔☺ ✔☺	✔☹	CBS would benefit from including signage/drain stenciling prohibiting illegal dumping. Continue citizen reporting of illegal spills/dumps. Continued pollutant monitoring by CBS and student volunteers is recommended, including periodic fecal coliform bacteria checks on sewer system integrity. Smoke and dye testing done to test for any connections between sanitary and stormwater systems. Detailed stormwater drainage maps exist for Swan Lake watershed and allow detection/source tracking. Recommend outlining process used to ID illicit connections and illegal dumping. While not recommended at this time, evaluating a stormwater ordinance at a future date could lead to consolidated regulatory requirements in one place for CBS and developers. Reviewing model ordinances for similar sized communities as Sitka would be a necessary first step prior to seriously pursuing an ordinance.

Program Element	Adequately Addressed	Partially Addressed	Not Addressed	Comments
4. Control of construction site stormwater runoff Does CBS have a program to reduce pollutants in stormwater runoff from construction activities disturbing greater than one acre? Does CBS have regulations that require sediment and erosion controls by operators? -do they include construction site BMPs (structural/non-structural)? -requirements to control site waste disposal? -site plan review procedures? -inspection and enforcement procedures? -require the filing/approval of a stormwater pollution prevention plan (SWPPP)?	✔☺ ✔☺ ✔☺	✔☺ ✔☺	✔☹	Relies on operator to file required NPDES Stormwater Pollution Prevention Plan (SWPPP) with ADEC. No local SWPPP filing requirement exists. Grading and filling permit now issued by Building Official, with review and inspection. Retain/maximize use of vegetative swales and sediment detention ponds to control runoff. Retain vegetation in drainage ditches to the degree possible. CBS would benefit from having a brochure of structural and non-structural BMPs as an educational "handout" for developers and as a reference tool for stipulating conditions in local permits. Recommend educating/training developers on minimum standards for SWPlans/water quality protection on large projects. Training CBS inspection staff on stormwater issues and controls would also improve compliance with BMPs.

Program Element	Adequately Addressed	Partially Addressed	Not Addressed	Comments
5. Post-construction stormwater controls for new developments Does CBS have a regulatory mechanism/program to address post-construction stormwater runoff? Does it include both structural and non-structural BMPs? -does it ensure long term operation and maintenance of BMPs?	✔☺	✔☺ ✔☺		Envir. Assessments are completed for major new developments. CBS would benefit from a written policy that clearly specifies O & M policies and inspection procedures and scheduling. Pre-construction review of BMP designs is recommended. A revegetation/reseeding manual for disturbed areas is recommended. Consider designing in oil water separators/catch basins, swales or other oil-retention structures (e.g. sorbent pad inserts) into new stormwater systems. Same recommendations as Item 4 on BMP brochure, developer/CBS training program, and retention of vegetative swales and wetlands for stormwater treatment.

Program Element	Adequately Addressed	Partially Addressed	Not Addressed	Comments
6. Good housekeeping & pollution prevention for municipal operations affecting stormwater quality				Could benefit from stenciling/signage on storm drains to minimize illegal dumping into stormwater system.
Does CBS have an O&M procedure that includes an employee training component with a goal of preventing or reducing pollution from municipal operations?		✔☺		Perform maintenance and inspections on a regularly scheduled basis and log the results.
-is stormwater system maintenance and operation included?)	✔☺			Semi-annual cleanout of catch basins on Lake Street and HPRoad occurs. As-needed basis for road side ditches. Would benefit from written schedule, including street cleaning.
-storm drain/CB cleanouts?	✔☺			
-snow disposal and road salt guidelines?		✔☺		
-illegal dumping controls?		✔☺		Homeowners BMP brochure addresses pollution prevention.
-landscape/lawn maintenance?	✔☺			
-street cleaning?	✔☺			
-hazardous materials storage rules?	✔☺			Waste oil collected at harbors/antifreeze at municipal landfill for over 10 years.
-collection facility for used waste oil/antifreeze?	✔☺			
-visual inspections?	✔☺			

VII. PROPOSED STORMWATER CONTROLS AND ACTION PLAN

This section links the eight objectives for the Swan Lake Stormwater Control Strategy to specific tasks designed to implement those objectives. Collectively, these tasks should help meet the goal of the Strategy to *"manage stormwater quantity and quality to ensure efficient drainage and the reduction of pollutants entering Swan Lake and its tributaries".*

THE ACTION PLAN FOR THE YEARS 2002 THROUGH 2006

Over twenty tasks are recommended for implementation over several years. These include *both* continuing tasks and newly-proposed tasks and practices. Responsible parties, completion dates and measures of success are included under each Task. Each Task is linked to one or more of the eight stormwater objectives described in the earlier section.

A single lead agency is necessary to ensure effective implementation. The Public Works Department is proposed as the lead entity for coordinating implementation of Swan Lake stormwater activities among all parties.

1. CONTINUING TASKS FOR STORMWATER TREATMENT AND CONTROL

The following tasks are ongoing and should continue to be implemented by the City and Borough of Sitka. All were previously reviewed by the public and approved in June 2000 as part of the *Swan Lake Watershed Recovery Strategy.* All have been successful to varying degrees in addressing stormwater runoff and lake water quality.

☛TASK ❶. *Retain the sedge grass community along the lake fringes and periodically clean sediments from the lake ditch paralleling Lake Street.*

Continuing periodic maintenance cleaning of the lake ditch channel between the sedges and Lake Street is recommended to remove collected sediments. Implementing this practice at other locations, where practical, is also recommended. Continuing the annual mucking out of the Arrowhead Cr/Monastery Street settling pond is also recommended.

The shoreline sedge grass community provides an important filtration and trapping function for sediments introduced to the lake from stormwater runoff and road bed erosion. They also provide habitat and food for waterfowl. These grasses should be retained along the perimeter of the lake.

Responsible party: CBS Public Works Maintenance and lakeshore residents
Completion date: Ongoing
Measure of success: Functional vegetative swale

☛TASK ❷. *Continue to document stormwater quality in the Swan Lake watershed.*

Control of sediments, oils and nutrients entering the lake is a focal point for any successful long-term lake rehabilitation and stormwater control effort. Further characterization of stormwater quality is necessary, continuing efforts begun in 1999. Measuring sediment and nutrient levels at permanent stations in Swan Lake, Wrinkleneck and Arrowhead Creek, and in stormwater ditches/outfalls is recommended to supplement baseline values. Runoff from the road system should also be addressed. A Quality Assurance Project Plan (QAPP) has been developed and approved by ADEC to guide future water quality data collection.

Future dye studies and/or periodic fecal coliform bacteria monitoring along the lake shore may be considered appropriate, as the need arises, to continue the municipality's ongoing evaluation of the integrity of the sewerage system and any sanitary overflows that could elevate fecal coliform bacteria levels in Swan Lake.

CBS currently supports active high school monitoring which provides students "hands-on" environmental education and other volunteer monitoring opportunities within the Swan Lake watershed. These mentoring and financial support efforts should continue.

Responsible party: CBS, student monitors, and contractor
Completion date: Ongoing
Measure of success: Reduced sediment and nutrient loads to the lake

☛TASK ❸. *Continue CBS-sponsored annual trash and debris cleanups in the Swan Lake watershed. Continue to use the CBS website to provide information on watershed efforts.*

The CBS has institutionalized the annual cleanup of trash and debris throughout the watershed. Over the last three years, volumes of material have decreased significantly. Cleanups ensure an aesthetically pleasing lake, ensure unobstructed stormwater flow is maintained through culverts, fish habitat is protected and give residents a sense of pride in their lake and streams. The CBS website has been a useful source of stormwater and watershed protection information.

Responsible party: CBS Parks and Rec and Public Works staff
Completion date: Ongoing, annually in April
Measure of success: Reduction in tons of debris and litter; unimpeded water flow

☛TASK ❹. *Retain riparian vegetation buffers along Swan Lake and its tributaries. Utilize landscaped areas (lawns, greenbelts, medians) as stormwater treatment areas.*

A 25 foot, no disturbance setback along each stream bank is specified in the Swan Lake AMSA. Vegetation within these natural buffers should be retained, as they serve important flood control, filtration and pollutant removal functions. Stormwater drainage ditch vegetation serves a similar purpose and should be retained wherever possible.

Responsible party: Lake and streamside residents; CBS Public Works Maintenance staff
Completion date: Ongoing
Measure of success: Functional vegetative buffers for bio-treatment of stormwater

☛TASK ❺. *Explore drainage improvements at the Monastery Street intersection at Wrinkleneck Creek, including culvert replacement, modification or bridge installation.*

The current culvert appears to be undersized to pass high water flows. The area would benefit from increased capacity by replacing the existing culvert or adding a second pipe. With Fish and Game Habitat support, rocks on the lower side of the stream should be removed. Lastly, a more costly option to removing the culvert - bridge installation - should receive further discussion on-site between ADF&G and CBS. Major structural improvements, such as a bridge, would require new grant funding. ADF&G support for the project would be sought.

Responsible party: CBS Public Works Maintenance/Engineering staff ; ADF&G Habitat
Completion date: June 2005
Measure of success: Improved drainage through Monastery/Wrinkleneck intersection

☛**TASK ❻**. *Improve drainage at the Arrowhead Creek/Monastery Street intersection. Continue maintenance dredging/cleaning of the settling pond at the location.*

The drainage into the Monastery Street crossing, lack of grade (limited gradient) and the 3 ft diameter culvert being less than optimally sized have created a periodic flooding problem. Various solutions have been examined, including upsizing (larger diameter) the existing culvert or installing a second pipe at Monastery Street, improving the hydraulic efficiency of the existing Lake Street/ Monastery Street culverts, or installing a 70 ft culvert along the vegetated ditch.

In April 2002, the US Forest Service completed a hydraulic analysis and survey of the area and **recommended** two options to improve stormwater drainage efficiency and reduce flooding risk in the Monastery Street area: 1) install a wing wall/apron inlet structure on the inlet of the Lake Street culvert and a headwall inlet (culvert barrel should be cut flush to the road sub-grade) at the Monastery Street culvert; or 2) replace the current 42" steel culvert at Monastery St. with a 60" x 46" aluminum pipe-arch structure. Subtask 1) above is scheduled for completion in July 2002. **Diverting** some stormwater drainage away from the Monastery St. intersection would also reduce **flood** potential. Continued routine maintenance dredging of the settling pond on the Arrowhead Creek section between Lake Street and Monastery Street is recommended. Such a program reduces sediment input to the lake and increases stormwater storage capacity.

The alternative to maintaining the site as a settling pond may be to completely re-engineer drainage in the area, which could include replacing and lowering the Arrowhead Creek/Lake Street culvert [4]. These actions would require a Corps of Engineers 404 permit. This is a longer-term solution that is more appropriately examined later if the "retrofits" to drainage improvements cited above are not effective.

Responsible party: CBS Public Works/Engineering
Completion date: August 2002 for installing wing wall/apron inlet structure
Measure of success: Improved drainage through area; reduced flooding

☛TASK ❼. *Implement best management practices re: stormwater management, cleanouts and maintenance of sediment catchment basins and plugged outfalls, snow management and road* ***salt usage.***

This task deals with more routine, ongoing best management practices. A number of institutional improvements in best management practices are recommended in the Action Plan. Training staff in these BMPs is implicit to the recommendation. These are ongoing management practices, with responsibility shared with the CBS and citizens of Sitka. Most are cheap; some will require a procedural or policy change or a change in public awareness.

- BMPs for snow management and road de-icing adjacent to Swan Lake
- Control sedimentation of creeks from building and construction practices
- Utilize landscaping areas (lawns, medians,etc) as stormwater treatment areas
- Retention of riparian vegetation within the Swan Lake AMSA buffers
- On Lake Street side, examine BMPs that use vegetated surface treatment areas as an alternative to structural catchment and treatment (i.e wetland swales)
- Verifying culvert throughput/absence of blockage/finer grid trash screens
- Regular storm drain sediment catch basin and plugged outfall cleanouts on Lake Street and Halibut Point Rd
- Limit use of high-phosphorus fertilizers; BMPs for disposal of lawn clippings/waste
- Periodic monitoring of fecal coliform levels in Swan Lake

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[4] Drainage problems at the Monastery Street intersection are largely the result of the insufficient gradient in the Arrowhead Creek/Lake Street culvert. This major culvert was buried two feet higher than shown in the original design plans due to encountering rock obstructions (Milt Ludington, personal communication). The current 0.1% gradient is less than optimal to efficiently pass water; the culvert needs to be dropped several feet. The alternative of removing and relocating this major culvert - while expensive - may need examination to comprehensively address drainage problems in the area. This is a costly, future task outside the scope of this Strategy. Costs of surveying, municipal purchase of new land for the right-of-way, design, and removal/installation of a new culvert is estimated at $150,000 to $200,000.

Responsible parties: CBS and watershed residents
Completion date: Ongoing
Measure of success: Reduction in pollutant loads to the streams and lake

☛TASK ❽. *Complete a vegetation and forest park management manual to guide lake and streamside buffer uses, including revegetation and reseeding of disturbed areas, clearing and brushing.*

This task will require new grant funding and should be considered as part of any FY04 319 grant application submitted by CBS to ADEC. Maintaining vegetative buffers adjacent to waterways is one of the best BMPs available for protecting water quality. Selective removal of vegetative cover is acceptable in some areas, but generally is not a good idea immediately adjacent to streams and lakes. This is precisely why the Swan Lake AMSA adopted in 1981 established vegetative buffer areas around the lake and Wrinkleneck and Arrowhead Creeks. An evaluation of the vegetation management policies in the Swan Lake AMSA against what is actually happening in the watershed should be completed and adjustments made, as necessary. Thinning of alders and evergreens around the lake should be done consistent with an overall plan. .

Several disturbed areas within these buffers would benefit from reseeding and revegetation as an alternative to allowing natural revegetation to progress. Careful selection of native species is necessary to avoid introducing undesirable, non-indigenous species into the lake and streams and to maximize stabilization of the disturbed areas.

Responsible party: Contractor with CBS oversight; Landscape Committee
Completion date: June 2004*;* grant request for FY04 funding
Measure of success: Reseeding and revegetation manual to guide CBS and citizen efforts

☛TASK ❾. *Continue to maintain waste oil and hazardous waste collection facilities and sponsor cleanup days.*

Waste oil collection facilities are located and maintained by CBS at the boat harbors. Hazardous wastes are collected at the CBS-managed landfill. Continuing regular CBS-sponsored household hazardous waste collection events is recommended.

Responsible party: CBS Environmental Dept./Landfill/Harbors
Completion date: Annually
Measure of success: Pounds of waste oil and hazardous wastes collected at CBS facilities

☛TASK ❿. *Encourage citizen reporting of illicit dumps and activities.*

The majority of spills and illegal dumps to the municipal stormwater system are detected and reported to CBS staff by watershed residents. Residents trained to see problems will help to support CBS ongoing efforts to reduce illegal dumping, spills and other pollution events. Such an

approach also puts peer pressure on neighbors to comply.

Responsible party: CBS Environmental Dept., residents
Completion date: Ongoing
Measure of success: Reduction in the number of spills and illegal dumps

☛TASK ❶❶. *Continue regular cleaning of culverts and sediment catch basins*

Several outfalls discharging to Swan Lake are plugged with sediments. Regular cleanouts of culverts/outfalls and catch basins before they plug up is a good preventive maintenance practice and will improve stormwater drainage efficiency.

Responsible party: CBS Public Works Maintenance
Completion date: Ongoing
Measure of success: Improved stormwater drainage

☛TASK ❶❷. *Continue use of the existing interdisciplinary watershed team to advise the CBS on the implementation of the Swan Lake stormwater control strategy.*

The current interagency team provides extended expertise to CBS on biological, hydrologic and engineering issues and helps ensure a consensus is reached on solving stormwater problems. The group should continue to advise the CBS.

Responsible party: CBS; interagency watershed team
Completion date: Ongoing
Measure of success: Interdisciplinary approach and consensus on stormwater issues

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2. NEWLY-PROPOSED TASKS FOR STORMWATER MANAGEMENT

☛TASK ❶. *Prepare a brochure of structural and non-structural best management practices for stormwater control and treatment as a "handout" reference tool for developers and CBS staff.*

CBS Public Works and Building Department staff, contractors and the public would benefit from having a "menu" of BMPs from which to select in reviewing and approving construction activities that result in stormwater runoff. A similar tool is used by ADEC Stormwater program review staff and allows the selection of a range of BMPs that are appropriate to the particular site conditions. New grant funds would be required and sought to complete the brochure.

New residential construction in the Swan Lake watershed is overseen by the Building Department, with issuance of a grading and filling permit. However, the current building code does not require enforcement of stormwater pollution control practices from construction sites; EPA and ADEC have enforcement authority over stormwater discharge permits. Therefore,

education of developers is the first step, recognizing the limitations in the local code. A simple brochure of recommended BMPs for reducing sediment and pollutant runoff from construction sites could be handed out to applicants concurrent with the building permit application packet to ensure developers are made aware of good practices. The brochure would also be a useful educational tool for CBS staff. Any new enforcement or compliance functions would require amendments to the Building Code.

Responsible party: CBS and/or contractor; distributed by Building Dept/ Public Works/Planning
Completion date: June 2004; grant request for FY04 funding
Measure of success: A user-friendly "menu" of BMPs in brochure format

☛TASK ❷. *Retain grasses and vegetation in drainage ditches to the degree possible to filter out sediments, oils and other stormwater pollutants. Formalize the Ditch Maintenance Plan.*

Grasses in drainage ditches slow down stormwater flow and allow sediments to settle out. The vegetation *also* serves as a natural swale - or wetland treatment - to remove metals, oils, and other pollutants in stormwater. Good examples of swales include the Arrowhead Creek/Monastery Street area and the vegetated areas below the High School. Leaving vegetation in place is particularly critical for ditches nearest to the lake, Wrinkleneck Creek and Arrowhead Creek. While removal of sediments from ditches removes vegetation, vegetation along the entire length of ditches should not be completely removed with backhoes unless it is conclusively demonstrated that the ditch is impeding stormwater flow. Such a policy is now followed by the City and Borough of Juneau for ditches draining directly to sensitive fish streams. The CBS Public Works Maintenance Department has drafted a master plan for ditch maintenance that, when finalized, could serve as the procedural document for implementing this task.

Maintaining the natural treatment properties of vegetation while not compromising the ability of ditches to carry stormwater is the challenge. Consideration should be given to scheduling a 3 to 5 year rotation of backhoe cleaning that targets every other ditch (or alternate neighborhoods) and documents each year's efforts. Ensuring all street maintenance crewmen and backhoe operators are aware of and briefed on the policy is essential so that staff are all "on the same page". Ditches closest to streams should be left vegetated to the degree possible.

Responsible party: CBS Public Works Maintenance staff
Completion date: Ongoing maintenance practice; September 2002 for Master Plan
Measure of success: Retention of vegetation in drainage ditches; improved water quality; ditch maintenance master plan.

☛TASK ❸. *Prepare a written policy that clearly specifies and schedules stormwater operation and maintenance policies and inspection procedures for CBS staff.*

CBS Public Works staff typically perform stormwater inspections and maintenance on an as-needed basis and maintain a tracking system. It is recognized that maintenance is often done on a

reactionary basis in response to problems. Also, stormwater system and ditch maintenance schedules must revolve around other weather-dependent activities such as crosswalk painting (dry pavement required) and asphalt crack sealing. However, several routine maintenance procedures lend themselves for a scheduled approach. CBS would benefit from standardized written procedures that specify regularly scheduled maintenance and inspections and the logging of results. Issues such as scheduled cleanouts of sediment catch basins, culverts, roadside drainage ditches, and street and parking lot sweeping lend themselves to a scheduled, proactive, approach. The Master Plan for ditch maintenance cited in Task ❷ above addresses only a subset of inspection and maintenance procedures and should be supplement with a broad O & M policy specifying procedures and scheduling for all routine maintenance and inspection operations. A tracking system should be set up to evaluate progress and determine upcoming priorities.

Responsible party: CBS Public Works Director/Maintenance Supervisor
Completion date: June 2003
Measure of success: Written policy of O & M procedures; O & M tracking system

☛TASK ❹. *Outline the process used to identify and respond to illicit connections/overflows and illegal dumping into the stormwater system.*

A map of stormwater drainage pathways was completed in June 2002 as part of this Strategy. It will improve source tracking and response to illegal dumping (e.g. motor oil, antifreeze) into stormdrains. The process for identifying illegal connections between the stormwater system and sanitary sewer system includes both smoke testing and dye testing. A written process and schedule would benefit staff and could be part of a regular CBS operator training element.

Responsible party: CBS Public Works
Completion date: June 2003
Measure of success: Process diagram on detection and response to illicit/illegal discharges

☛TASK ❺. *Sponsor a volunteer storm drain stenciling effort and wetland plantings in the Swan Lake watershed and on-site education on the value of riparian vegetation to treat stormwater runoff.*

Storm drain stenciling has been used extensively by municipalities to emphasize the values (fish, water quality) affected by stormwater and to highlight prohibited practices (no oil dumping). Stenciling is fun, cheap, and involves local residents with a stake in maintaining high water quality. Selective reseeding and/or wetland plantings along the Spit area, public lands along the banks of Wrinkleneck Creek, and at erosional sites in Moller Park would enhance water quality and bank stabilization. Careful selection of species that are adapted to the area is paramount; the Corps of Engineers maintains a list of approved species. The local Landscape Committee and the CBS Public Works Groundskeeper would be advisors and participants in this task. Plantings on private lands must receive homeowner permission. Lastly, outdoor education would be provided to students and residents on the linkage of vegetation and stormwater treatment.

Responsible party: CBS Parks and Rec/Landscape Committee/CBS Groundskeeper
Completion date: May 2004
Measure of success: Completed storm drain stenciling; wetland reseedings and plantings

☛TASK ❻. *Maintain oil-water separators and catch basins to ensure maximum treatment efficiency. Consider the need for designing in new OWSs or other oil-retention structures in newly-constructed or modified stormwater drainage systems.*

Oil-water separators (OWSs) are installed along Halibut Point Road but do not exist along other major roads in the Swan Lake watershed. The Swan Lake watershed is a non-industrial area and is not at risk for many of the chemicals associated with industrial areas. However, additional OWSs or other oil-retention traps (e.g. swales, sorbent pad inserts) located in strategic locations should be considered for reducing road, parking lot and residential oils from getting into Swan Lake. As with sediment catch basins, a regular program of maintenance and cleaning is essential or the effectiveness of oil-water separators is compromised. The feasibility of maintaining the OWSs must be assessed before design and construction proceeds. Given the realities of maintenance constraints, and the fact that Swan Lake is a non-industrial watershed, a combination of vegetative swales (low maintenance cost) and structural oil-water separators/oil traps (high maintenance cost) to collect and remove oils is preferred, with a nod towards vegetated swales. At minimum, the existing OWSs should be cleaned on a scheduled basis and be made part of the O & M policy in Task ❸ above.

Responsible party: CBS Engineering and Public Works Maintenance; DOT&PF
Completion date: Ongoing
Measure of success: Reduced oil inputs to Swan Lake

☛TASK ❼: *Complete an engineering analysis of stormwater transport in the watershed, including culvert grades, throughput capacity and effective life, and drainage bottlenecks.*

Completing this task requires new outside funding. The CBS has discussed and sought funds to complete a comprehensive engineering study of the stormwater drainage in the Swan Lake watershed and the entire municipality. Optimizing stormwater transport requires analysis of existing culvert grade and capacity problems, age of culverts, pinpointing areas that need new outfalls/culverts, and a plan for funding these upgrades into the future. The current - largely reactionary - approach has identified the Arrowhead Creek/Monastery Street and Wrinkleneck Cr/Monastery Street intersections as problematic. A thorough analysis of drainage in the entire watershed would undoubtedly identify other current or future problem areas. Compiling this information in a presentable format would help secure federal, state and local funding for any upgrades.

Responsible party: CBS Engineering and Public Works Maintenance
Completion date: June 2005; grant application for FY05 funds
Measure of success: Improved stormwater transport efficiency

☛TASK❽. *Designate a lead entity to coordinate implementation of the Stormwater Control Strategy.*

The Public Works Department is the logical lead entity within the CBS to facilitate and coordinate among all parties on stormwater issues. Formally designating a lead entity in writing is important to ensure a single point of contact and responsibility for tasks. An internal memo from the Public Works Director or City Administrator would serve this purpose. It is recognized that this is a new responsibility, and as such, effort must be balanced against high priority capital project work and other operational needs of the Department.

Responsible party: CBS Public Works Director
Completion date: September 2002
Measure of success: Memo/letter confirming lead entity on stormwater issues

☛TASK ❾: *As part of the proposed municipal GIS project, include a city-wide inventory and map of stormwater directional drainage patterns on an intersection-to-intersection scale similar to the map for the Swan Lake watershed.*

While it is uncertain whether the CBS will be required by EPA to complete a stormwater management plan for the entire municipality, the completion of a municipal stormwater drainage map beyond the boundaries of the Swan Lake watershed makes sense on its own merits. Indeed, the CBS has proposed a GIS mapping project that, if funded, would be the logical place for rolling in a citywide stormwater drainage map. The two projects are linked. The value of such a map is clear and was specifically requested by CBS staff to be a key element of the Swan Lake Stormwater Control Strategy. This task will require substantial funding. New grant or other funds would be required to complete the map.

Responsible party: CBS Public Works staff with contractor assistance
Completion date: June 2005; contingent on receiving new funding for proposed GIS project
Measure of success: Stormwater drainage maps for municipality

☛TASK ❿. *Educate developers on minimum standards for stormwater and water quality protection in the Swan Lake watershed. Train CBS inspection staff on stormwater issues and controls.* [5]

Educating developers on "tried-and-true" stormwater BMPs and minimum water quality protection standards for construction projects will result in improved compliance with water quality standards. This task is linked to the BMP brochure (Task 1). Educational and/or training programs have been used by many municipalities as tools to help ensure knowledge of appropriate BMPs and local standards. Also, training CBS inspection staff will help ensure they will spot and quickly remedy problems on-site. Grants would be used to hire a contractor to conduct any new

[5] This task would require new funding for training of municipal employees.

comprehensive training.

Responsible party: CBS and training course contractor
Completion date: by June 2005
Measure of success: Informed developers; trained CBS staff

☛TASK ❿. *Consider implementing a local "development agreement" between CBS and developers to establish municipal standards for construction activities in the Swan Lake watershed.*[6]

Operators with construction activities that results in land clearing greater than one acre are required to file a Stormwater Pollution Prevention Plan (SWPPP) with ADEC and get approval prior to construction. No similar *local* requirement is currently in place in the Swan Lake watershed. The CBS has been considering the benefits of preparing a "development agreement" between the CBS and developers to highlight municipal standards for construction projects. Potentially, one of several elements in the agreement could be requiring the local filing and signoff of stormwater pollution prevention plans submitted to EPA and ADEC. The CBS currently requires local approval of SWPPPs for industrial gravel mining leases in the Granite Creek watershed. Establishing a construction area threshold for submittal of a development agreement is an option for consideration. This new requirement would likely require a new ordinance with commensurate funding for staff review of development plans and SWPPPs.

Responsible party: CBS Public Works and/or Building Depts.
Completion date: January 2005; contingent on Assembly ordinance changes and funding
Measure of success: local development agreeements with minimum construction standards

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[6] This task would require Assembly passage of an ordinance and subsequent funding for the new development agreement/SWPPP review function.

SUMMARY OF THE STORMWATER ACTION PLAN FOR 2002 THROUGH 2006

SWAN LAKE STORMWATER CONTROL STRATEGY	Objective Supported / [7]	Responsible Party(s)	Completion Date
ACTION PLAN FOR 2002 TO 2006			
-Continuing Stormwater Control Practices-			
❶ *Retain lakeside sedge grass community as sediment trap*	1,3,4	CBS PW Maintenance	Ongoing
❷ *Continue to document stormwater quality*	5	CBS /students/contractor	Ongoing
❸ *Continue annual trash and debris cleanups*	2,4	CBS Parks and Rec/WW	Annually
❹ *Retain riparian vegetated buffers in the AMSA*	1,7	Residents; CBS PW	Ongoing
❺ *Improve drainage at the Monastery/Wrinkleneck site*	8	CBS PW Mainten./Engin.	June 2005
❻ *Improve drainage at the Arrowhead/Monastery site*	8	CBS Mainten/Engineering	Aug 2002
❼ *Implement ongoing stormwater control BMPs*	3,4	CBS Depts & residents	Ongoing
❽ *Complete revegetation/reseeding manual for disturbed sites*	1,2,4	Contractor w/CBS oversight	June 2004
❾ *Continue to maintain waste oil and antifreeze/haz waste collection facilities*	4	CBS Environment/Harbors	Ongoing
❿ *Encourage citizen reporting of illicit dumps/activity*	2	Residents/CBS Environ	Ongoing
❿❶ *Regular cleanouts of plugged culverts/catch basins*	3,4	CBS Pubic Works Mainten	Ongoing
❿❷ *Continue use of watershed team to advise CBS*	2,4	CBS; Interagency team	Ongoing
-Proposed Stormwater Management Tasks-			
❶ *Prepare a reference brochure of stormwater BMPs*	1,3,4	CBS and/or contractor	June 2004
❷ *Retain grasses/swales in drainage ditches for filtration*	1,3	CBS PW Maintenance	Ongoing, 9/02
❸ *Prepare written policy on scheduled O&M practices*	1,3,4	CBS Public Works Director	June 2003
❹ *Outline process to ID illicit connections/illegal dumping*	4,.6	CBS Public Works	June 2003
❺ *Sponsor volunteer storm drain stenciling, reseeding and plantings*	1,2	CBS Parks and Rec/Groundskeeper	May 2004
❻ *Maintain oil-water separators/catch basins; consider including oil-retention structures or swales in newly-constructed systems*	3	CBS Enginr/Public Works	Ongoing
❼ *Complete an engineering analysis of stormwater drainage and identify needed upgrades*	3,8	CBS Engin / PW Mainten	June 2005
❽ *Designate a lead entity in CBS for SW coordination*	4,6,7	CBS Public Works Director	Sept 2002
❾ *Include city-wide stormwater drainage map as an element of proposed GIS mapping project*	7	CBS PW with contractor	June 2005
❿ *Educate developers/train CBS staff on minimum standards for stormwater/water quality protection*	4	CBS and course contractor	June 2005
❿❶ *Consider a local development agreement for specifying construction standards in the watershed*	4	CBS Publ Works/Building	Jan 2005

[7] See *Goal and Objectives* Section (pages 8-9) for a complete list of stormwater program objectives for the Swan Lake watershed..

FUNDING, PROGRAM COORDINATION AND SELF ANALYSIS

Several of the tasks in the Action Plan will require additional funding to complete. Many others will simply require changes in internal procedures. One benefit of having all goals, objectives and tasks under one Strategy is its use as a reference document to maintain consistency in operations, stated goals and priorities, and a consistent focus over time. The document also provides the context and rationale for future requests of additional funding.

Maintaining the current Swan Lake watershed advisory team of local, state, and federal representatives, along with lakeside residents, will help continue to focus attention on stormwater issues and help in their solution. The use of this team to address drainage problems at the Arrowhead Creek/Monastery St. intersection is but one of many examples of the value of an interdisciplinary, team approach to solving problems. The team extends CBS staff and expertise.

Consulting and communicating closely with other communities around Southeast Alaska will help in the exchange of information on successful stormwater management. Experimental use of swales for stormwater treatment, drainage ditch maintenance policies and citizen participation such as storm drain stenciling have all been variously used by Juneau and other Southeast communities. Relating those experiences will benefit Sitka.

The City and Borough of Sitka's Public Works Department is the logical "lead agency" within the municipality to facilitate the coordination of the various stormwater pollution control activities. Intra-departmental, as well as intergovernmental, coordination is an important aspect of a successful program. Integrating stormwater management elements into the community's land development and comprehensive planning process is important. Site plan reviews, land use planning, and variances are examples. Staffing and equipment resources committed to implementing the Stormwater Strategy should be identified.

Charts, matrices, or other critical path analyses are tools that are recommended as ways to organize a stormwater O & M program and scheduling.

If EPA makes a decision in December 2002 that CBS is covered under the Phase II stormwater regulations for Small Municipalities, a comprehensive self-analysis should be completed to assess the current program with respect to complying with the federal requirements. *It is the intent of this Swan Lake Stormwater Control Strategy to assist the CBS by providing pertinent information and a "head start" towards a municipal-wide analysis.*

What is realistically achievable in the Action Plan is a function of funding, political will, and the degree of the problem that needs fixing. The *Swan Lake Stormwater Control Strategy and Action Plan* are flexible enough to adjust to these realities. The Strategy should be periodically revised and updated as conditions change. The Action Plan is currently written through 2006.

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APPENDICES

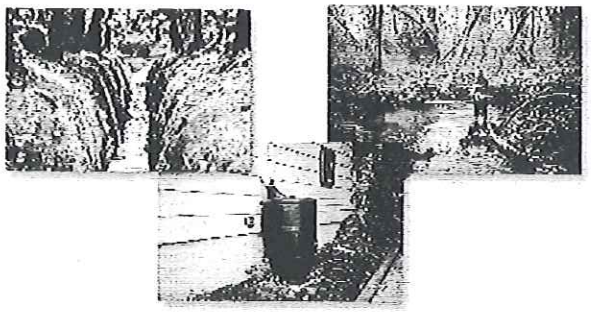
1. EPA's national menu of BMPs for Stormwater Phase II program.
2. Map of Swan Lake Stormwater Drainage, with elevations, catch basins and conveyances
3. Sport Fish Division water quality monitoring results, 1979
4. ADEC metals and pesticide results from Swan Lake and Wrinkleneck Creek (1991)
5. *A Citizen's Guide to Protecting Water Quality in the Swan Lake Watershed*
6. *Consumer Alert for Homeowners with Heating Oil Tanks.*

EPA United States Environmental Protection Agency
Office of Water

OFFICE OF WASTEWATER MANAGEMENT

National Menu of Best Management Practices for Storm Water Phase II

Storm Water
- Home
- What's New
- FAQs
- Publications
- Regulations
- Training
- Links
- Contacts



Get Acrobat Reader

Welcome to EPA's Storm Water Phase II Menu of Best Management Practices (BMPs). The menu is intended to provide guidance to regulated small MS4s as to the types of practices they could use to develop and implement their storm water management programs. The menu is intended as guidance only.

The Storm Water Phase II rule was published on December 8, 1999, and generally requires operators of small MS4s in urbanized areas to develop and implement a storm water management program which addresses six minimum control measures. A series of fact sheets describe the various components of the Phase II rule.

The information below provides guidance for regulated small MS4s developing a Phase II storm water program.

The storm water pollution problem has two main components: the increased volume and rate of runoff from impervious surfaces, and the concentration of pollutants in the runoff. Both components are directly related to development in urban and urbanizing areas. Together, these components cause changes in hydrology and water quality that result in a variety of problems, including habitat modification and loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion. Effective management of stormwater runoff offers a multitude of possible benefits, including

BMP Topics

BMP Menu

1. Public education & outreach on storm water impacts

2. Public involvement & participation

3. Illicit discharge detection & elimination

4. Construction site storm water runoff control

5. Post-construction storm water management in new development & redevelopment

6. Pollution prevention & good housekeeping for municipal operations

Downloadable Files

Measurable Goals

Storm Water Phase II

protection of wetlands and aquatic ecosystems, improved quality of receiving waterbodies, conservation of water resources, protection of public health, and flood control.

In addition to chemical pollutants in storm water, the physical aspects related to urban runoff, such as erosion and scour, can significantly affect a receiving water's fish population and associated habitat (EPA, 2000). Alterations in hydraulic characteristics of streams receiving runoff include higher peak flow rates, increased frequency and duration of bankfull and subbankfull flows, increased occurrences of downstream flooding, and reduced baseflow levels (EPA, 1999). Traditional flood control measures that rely on the detention (storage) of the peak flow (referred to as peak shaving) have been characteristic of many storm water management approaches, have generally not targeted pollutant reduction and in many cases have exacerbated the problems associated with changes in hydrology and hydraulics. EPA recommends an approach that integrates the control of storm water peak flows and the protection of natural channels to sustain the physical and chemical properties of aquatic habitat.

Minimum Measures and BMPs

The Phase II rule describes six minimum control measures which most regulated small MS4s will need to implement. EPA anticipates that these minimum control measures typically will be implemented by applying one or more BMPs appropriate to the source, location, and climate. The practices listed in the menu of BMPs have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the minimum control measures.

EPA recognizes that there is often site-specific, regional, and national variability in the selection of appropriate BMPs, as well as in the design constraints and pollution control effectiveness of practices. The list of practices for each minimum control measure is not all-inclusive and does not preclude MS4s from using other technically sound practices. In all cases, however, the practice or set of practices chosen by the MS4 needs to achieve the minimum measure.

EPA recognizes as well that some MS4s may already be meeting the minimum measures, or that only one or two practices may need to be added to achieve the measures. Existing storm water management practices should be recognized and appropriate credit given to those who have already made progress toward protecting water quality. There is no need to spend additional resources for a practice that is already in existence and operational.

BMPs as Systems

Effective storm water management is often achieved from a management systems approach, as opposed to an approach that focuses on individual practices. That is, the pollutant control achievable from any given management system is viewed as the sum of the parts, taking into account the range of effectiveness associated with each single practice, the costs of each practice,

and the resulting overall cost and effectiveness. Some individual practices may not be very effective alone but, in combination with others, may provide a key function in highly effective systems. The Phase II rule encourages such system-building by stating the minimum requirements in more general terms, which allows for the use of appropriate situation-specific sets of practices that will achieve the minimum measures.

Prevention vs. Treatment

Once pollutants are present in a water body, or after a receiving water body's physical structure and habitat have been altered, it is much more difficult and expensive to restore it to an undegraded condition. Therefore, the use of a management system that relies first on preventing degradation of receiving waters is recommended. BMPs under the each of the minimum measures—particularly the obvious category of pollution prevention, as well as outreach, education, and erosion and sediment control—focus on the prevention of pollutants from ever getting into storm water. Similarly, some of the practices under the post-construction runoff control minimum measure address site design issues that can result in pollution prevention.

The menu of BMPs is based on Phase II's six minimum control measures. Click on the minimum control measure below to see the Phase II requirements for that minimum measure and the BMPs which could be used to implement the measure.

1. Public education and outreach on storm water impacts.
2. Public involvement/participation.
3. Illicit discharge detection and elimination.
4. Construction site storm water runoff control.
5. Post-construction storm water management in new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Top

Table 3. Water Quality Analysis of Swan Lake, Sitka, 1979 (Source - Art Schmidt, ADF&G, Sitka).

Parameter, Unit	
Specific Conductance, umho	83.000
pH	6.800
Hardness, mg/l	29.000
Alkalinity, mg/l	24.000
Calcium, mg/l	3.016
Magnesium, mg/l	1.760
Sodium, mg/l	5.822
Potassium, mg/l	0.783
Iron, mg/l	2.633
Manganese, mg/l	0.085
Molybdenum, mg/l	0.020
Aluminum, mg/l	0.270
Boron, mg/l	less than 0.100
Silica, mg/l	10.000
Fluoride, mg/l	less than 0.010
Chloride, mg/l	3.800
Sulfate, mg/l	13.500
Nitrate, mg/l	less than 0.100
Nitrite, mg/l	0.020
Ortho-Phosphate, mg/l	less than 0.010

Table 2. Thermal Data (°C) from Swan Lake, Sitka, 1979.

Depth (m)	May 31	July 3	July 20	Aug. 9	Aug. 29
S	12.5	15.9	15.5	17.5	19.8
1.0			15.5	15.6	19.5
2.0			13.5	13.0	16.0
3.0	12.0		12.5	12.2	11.2
4.0			12.0		

STATE OF ALASKA
Department of Environmental Conservation

Environmental Quality Monitoring and Laboratory Operations
750 St. Ann's Avenue
Douglas, Alaska 99824
Tel. No. 364-2155

PRIORITY POLLUTANTS
Analytical Report for Sitka - Colleen Burgh

SAMPLE NUMBER 02CB83
Date Collected 8-30-83

LABORATORY NUMBER 83083111
Time Collected 0759

INORGANICS

	ug/g (dry weight)
Antimony	--
Arsenic	6.0
Berilium	--
Cadmium	0.2
Chromium	8.0
Copper	7.0
Lead	5.0
Mercury	0.9
Nickel	9.0
Selenium	--
Silver	--
Thalium	--
Zinc	57.
Cyanide	--

PESTICIDES AND PCB'S

	ug/l
Aldrin	--
Chlordane	--
Dieldrin	--
4,4'DDT	--
4,4'DDE	--
4,4'DDT	--
Alpha Endosulfan	--
Beta Endosulfan	--
Endosulfan Sulfate	--
Endrin	--
Endrin Aldehyde	--
Heptachlor	--
Heptachlor Epoxide	--
Alpha BHC	--
Beta BHC	--
Gamma BHC	--
Delta BHC	--
Toxaphene	--
PCB 1016	<0.1
PCB 1221	<0.1
PCB 1232	<0.1
PCB 1242	<0.1
PCB 1248	<0.1
PCB 1254	<0.1
PCB 1260	<0.1

Values below the level of quantitation are expressed as < (less than). All analyses included Quality Control. Methods and Q.C. data are available on request.

1 gram = 10^3mg (milligrams) = 10^6ug (micrograms)
1 mg/l = 1 ppm (parts per million)
1 ug/l = 1 ppb (parts per billion)

10-29-84
Date Completed

T. R. Trible
Chief, EQMLO

10-30-84
Date Reported

Table 4. Swan Lake sediment trace metal and pesticide levels (ADEC, 1984)

DON'T.....

- place fills, structures, or clear land within the 15 foot protected buffers along each side of the creeks and 50 feet around the lake shore without prior city approval
- Dump oil into the stormdrains. It ends up in the lake
- Dump grass clippings or leaves in the lake or streams
- Cut or remove trees, shrubs or other vegetation within the protected streamside and lakeshore buffers that result in soil erosion or loss of cover
- Channelize or obstruct stream flow with residential fills without approval
- Store oil or liquids within the 15 ft setbacks from the creeks and 50 ft lake setback
- Dump aquarium contents into the lake or streams. You don't want milfoil or other exotic species taking root!
- Let polluted runoff get into the lake and creeks
- Throw trash, tires, metals or debris into the lake or streams

DO.....

- Accept that you have an effect on the watershed and a responsibility to keep it clean
- Make sure you understand local and other permit requirements before you work near the lake or streams
- Clean up litter, trash and metals
- Review the Swan Lake Watershed Recovery Strategy to better understand what is planned
- Retain streamside and lakeside vegetation. It filters out sediments, nutrients and pollutants.
- Use low phosphorus fertilizers on lawns
- Volunteer your help in annual lake cleanups and scientific study on the lake
- Check your aboveground home heating oil tanks for leaks and oil smells
- Call the municipality if you see problems that need attention
- Fish, boat and have fun in your lake!

GO FOR IT!

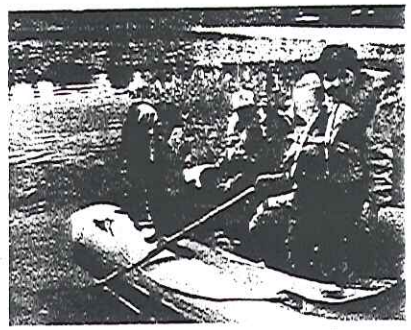
Volunteers play an important role in keeping watersheds clean and healthy. Regulations can only do so much. Look for opportunities to become involved in the restoration projects around the watershed over the next several years. You'll be pleased with and proud of the results. Have fun!

For more information, call:

- Mark Buggins, CBS Env. Supt., 966-2256
- Marlene Campbell, CBS Coastal Management Coordinator, 747-1855
- Barnaby Dow, CBS Parks and Recreation Coordinator, 747-1852
- Doug Redburn, Project Environmental Consultant, 789-0057

A CITIZEN'S GUIDE TO PROTECTING WATER QUALITY IN THE SWAN LAKE WATERSHED

Little things you can do to help keep your lake and streams clean



By the

City and Borough of Sitka
100 Lincoln Street
Sitka, Alaska 99835

June 2001

WHAT'S THE PROBLEM?

Protecting water quality in Swan Lake and slowing the natural trend towards the lake filling up with vegetation require effort by lakeside and watershed residents. The City and Borough of Sitka needs your help.

Swan Lake, Wrinkleneck Creek and Arrowhead Creek comprise an important urban watershed for Sitkans. It's central location and importance for sport fishing, bird watching, wildlife habitat and winter recreation led to the designation of the Swan Lake Area Meriting Special Attention (AMSA) in 1981. This action resulted in setting management objectives and policies to guide development and protection of the watershed. Enhancing recreational, fisheries and water quality values is the main management objective. Proper and improper uses are identified in the AMSA and are enforceable policies under the Sitka Coastal Management Program.

Over decades, Swan Lake and its tributary streams have experienced, and will continue to experience, threats to their values. These threats and problems have included:

- Unauthorized removal of streamside (riparian) and lakeshore vegetation and encroachment on stream channels and their banks
- Unauthorized residential or commercial fills that degrade wetland and water quality
- Overabundance of lake aquatic plants and organic bottom deposits that are slowly filling in the lake, coupled with periodic depression of dissolved oxygen
- Sediment and nutrient introduction from road maintenance, stormdrains and bank sloughing and erosion
- Debris, metals and solid wastes
- Periodic fecal coliform bacteria levels higher than healthful levels

The result is that Sitkans have gradually seen a reduction in the values of Swan Lake.

Most of these problems are due to widespread - or nonpoint - sources of pollution, like urban runoff and land use management practices around the lake and streams.

Swan Lake has over 20 stormwater outfalls draining into the lake, with potential to carry fertilizers, salts, oils, chemicals and runoff from roads and residences. Wrinkleneck and Arrowhead Creek also can carry pollutants into the lake.

Principle sources are:

- multiple stormwater outfalls draining to the lake
- fill encroachment on vegetated streamside buffers
- modifications to natural drainage, including road paving and culverting
- road sedimentation

THINGS THAT ARE BEING DONE TO HELP RESTORE SWAN LAKE

In 1999, the City and Borough of Sitka began preparing a comprehensive Strategy to guide restoration of the Swan Lake watershed. Many Sitkans contributed to this document. The completed Strategy addressed water quality, habitat and hydrologic issues and proposed solutions to each. The following priority tasks are scheduled through 2002:

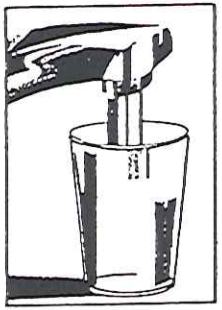
- dredge the lake outlet channel to improve water flow out of the lake
- harvest lily pads in high use recreational areas to improve lake access
- document nutrient and sediments entering the lake from stormdrains and creeks
- establish a school and citizen water quality monitoring program to provide information on watershed changes
- replace or upgrade culverts to reduce backstreet flooding
- remove flow restrictions at the mouth of Wrinkleneck Creek

HERE'S WHAT YOU CAN DO TO KEEP YOUR LAKE AND STREAMS CLEAN!

Here is where YOU come in. Increasing public understanding of lake problems and adopting best management practices for lakeside residents to reduce plant growth and pollution is the subject of this brochure. Good and bad practices are listed here.

Why It's Important

Many communities and individuals in Alaska obtain their drinking water from underground sources. Our climate and geology make it easy for spilled petroleum to move around underground. This can lead to drinking water contamination requiring years to treat or to dissipate.



Inhaled fumes from fuel spills may be a health threat to both people and animals, and also pose dangers from explosions.

Policy or Advice?

DEC recently rescinded its home heating oil tank "policy" because of confusion about its application. The department is not authorized under state law to regulate home fuel tanks, but is required to deal with major spills from any type of tank. It is important that the Legislature and the public decide the role, if any, DEC should have in home tank regulation. Meanwhile, department staff will gladly provide information or advice upon request.

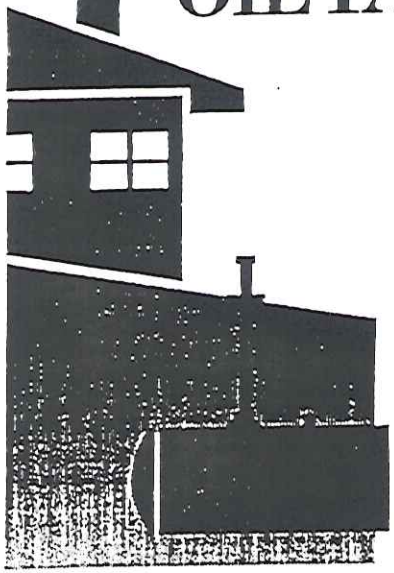
Repair and properly maintain your heating oil tank, and you will safeguard yourself, your neighbors and one of your biggest investments—your home.

laska Department
f Environmental Conservation
.O. Box O
uneau, Alaska 99811-1800

CONSUMER ALERT

REV 3/95

FOR HOMEOWNERS WITH HEATING OIL TANKS

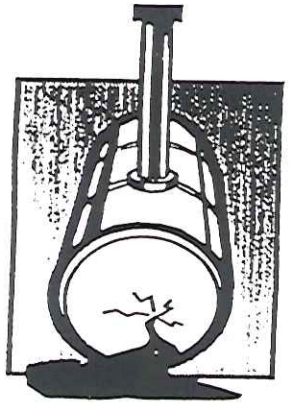


Alaska Department of
Environmental Conservation

Do you have a fuel oil tank at your home?

Here is information that may help protect your health and one of your largest financial investments.

Homeowners have expressed confusion about which laws apply to home heating oil tanks. Lending institutions, concerned about potential liability, have told some they are required to have assessments by environmental consultants to determine whether their tanks are leaking or if they have had any spills — even if there are no signs of leaks or spills. Others have been told they must remove underground heating oil tanks no longer in use.



Site assessments and tank removals are expensive. Neither are required by state law unless there has been a serious spill. However, municipal ordinances may require the removal of unused underground tanks in some cases.

Leaks and spills can occur, and when they do the value of your property may go down. Here is what you can do to protect yourself and your investment:

What to Watch For

✔ Check around the fill pipe on the day your fuel is delivered. If fuel has been spilled, call your distributor immediately to clean it up.

✔ Watch your fuel level. Unusually high consumption may indicate a leak or other problem needing attention. Loss of fuel could be the only obvious indication of an underground leak.

✔ Be aware of any fuel odors, large areas of darkened soil, or dead or absent vegetation around the fill pipe. Watch for pooled oil or sheens around your tank or furnace room. Any of these may indicate a problem that should be fixed immediately. Don't let a small problem turn into a big one.

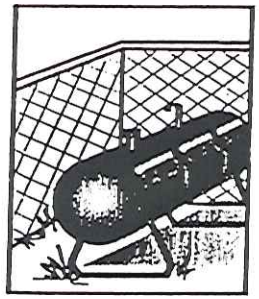
Protect Your Investment

✔ Periodically check the pipe connections to your tank to make sure they are tight. Also, be certain they are in dry, well-drained gravel that will remain ice-free during cold winter months.

✔ Most home heating oil tanks are bare steel, installed underground. Steel naturally corrodes when it is in contact with soil. If your tank is more than ten years old, consider replacing it with a new tank that is cathodically protected and coated. It will cost more up front, but may save you money down the road.

✔ Ask your fuel distributor to have your delivery person place fuel-absorbent material around the fill pipe before filling your tank. This should be easy to do in most cases, and will catch many small spills.

✔ Also consider installing a simple manufacturer's-covered steel or concrete catchment basin around your fill pipe. These inexpensive devices may pay big dividends.



✔ Protect your tank from vandalism. Above-ground tanks may need special safeguards.

✔ In the next several months, the state is starting a program to certify installers of commercial tank systems. Consider hiring someone who is certified if you have any work done on your residential tank. This should help ensure that the work is done competently. In the meantime, DEC maintains a list of firms providing tank services. The list is available to the public at no charge.

For information, call:

RobertKrogseng, DEC Anchorage, 563-6529;
Steve Bainbridge, DEC Fairbanks, 451-2360;
Randy Rice, DEC Juneau, 789-3151, or contact other DEC district offices.