Municipal Stream Classification: Anchorage, Alaska

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CLASSIFICATION OF MUNICIPAL HYDROLOGIC FEAtURES

The Municipality of Anchorage (MOA) requires clear definitions and mapping criteria for identifying and locating surface and drainage waters ("hydrologic features") within its corporate boundaries. Surface streams where defined as "U.S. waters" have long been subject to a range of regulatory and legal controls which constrain activities near and within these waterways. Under the federal NPDES rule for discharging storm water to natural waters, Anchorage drainage waters have also become subject to more rigorous regulatory constraints. Current local, State and federal definitions of U.S. waters are very broad but, in the past, have been generally adequate for resource and landuse management along Anchorage's mainstem watercourses. However, continuing urbanization within upstream tributary areas and increased federal oversight of storm water discharges has raised controversial issues of identification and drainage maintenance for smaller surface water flows.

The definitions and mapping criteria presented in this synopsis attempt to address this increased complexity by providing tools for identifying and classifying hydrologic features (including streams and drainageways) that will meet legal as well as practical urban planning needs. These definitions and criteria are intended to provide a single unambiguous standard for classification of the Municipality's surface and drainage waters for a multitude of management purposes. The definitions broadly encompass all marine shoreline, lake, pond, wetland, stream and drainageway features (including natural and constructed storm flow conveyances). The definitions and mapping criteria presented here have been developed primarily to reflect current Municipal administrative code and to support practical Municipal management information needs. However, all definitions and mapping criteria are also founded on nationally-established technical characterizations of hydrologic features and are defensible on this basis. Finally, they have also been shaped in context with a normal understanding of these types of features so as to provide a credible basis for public acceptance of mapping performed using these criteria.

MUNICIPAL HYDROLOGIC FEATURES

Within the Municipality's hydrologic classification system, six major classes of features are recognized: 1) marine features, 2) ground water features, 3) snow and ice features, 4) 'stillwater' or lake features, 5) wetland features and 6) 'watercourse' features, including both streams and drainageways (Table 1). These classes are briefly summarized below and are defined in the Definitions section of this document.

TABLE 1
MOA HYDROLOGIC FEATURES

Marine

Ground Water

Snow and Ice

Stillwater
- ***Lake***

Wetland

Watercourse
- ***Stream***
- ***Drainageway***

Marine features include all geographic areas with surface elevations below the local mean high water line (MHWL). For the MOA, Cook Inlet, Turnagain Arm, and Knik Arm and all of their associated embayments comprise "marine" features. A marine feature is bounded by a linear feature

called a "shoreline" which is generally coincident with the MHWL and marks the boundary between marine waters and land.

Ground Water features include all spatially significant and definitive water-saturated zones beneath the earth's surface, both shallow and deep. They include aquifer (potable water-producing) and non-aquifer features. This map class also includes important surface zones where surface and ground water interact (including ground water 'recharge' and 'discharge' zones).

Snow and Ice features include naturally-occurring perennial accumulations of snow and ice, including glaciers and snowfields. This class also represents any significant natural accumulation of snow that recurs annually or periodically but that is typically melted by the end of a summer.

Stillwater features include all lakes and ponds. Lakes are generally perennial or ephemeral inland bodies of open, standing water. Lakes are characterized by open water—thus, standing water that exists solely amongst vegetation (e.g., as in a swamp, marsh or mire) does not comprise a "lake".

Wetland features include all wetland areas as defined by the U.S. Army Corps of Engineers. 'Intertidal' or coastal wetlands (brackish water features) are administered directly by the Corps of Engineers. The inland boundary of these features is typically delineated at the mean higher high water line on Municipal map sets. 'Freshwater' wetlands are administered by the Municipality under the Anchorage Wetlands Management Plan (Municipality of Anchorage, 1996). Wetlands administered by the MOA generally comprise three different management types: 1) designation A wetlands, 2) designation B wetlands and 3) designation C wetlands. Any wetland feature may also include 'deepwater wetland' components, also mapped as 'lake' features in MOA lake datasets.

Finally, *Watercourse* features include all natural or man-made channels or conduits that have been formed as the result of flowing water, or that in fact do, or are intended to, convey surface water flows. Watercourse features include two general types: 'Streams' and 'Drainageways'. Both streams and drainageways may have either natural or man-made channels. All streams and drainageways have beginning points ('sources' and 'inlets' respectively) and an ending point (an 'outlet' for streams and natural drainageways and an 'outfall' for constructed drainageways). In general, streams and drainageways can be distinguished by differences in the source and longevity of flow. Streams always have relatively prolonged and (at least in their original unmodified form) natural sources of flow. Conversely, drainageways convey only ephemeral storm water flows, or those flows resulting from drainage or other construction. Streams and drainageways in the context of this document have very specific defining criteria (see the Definitions section of this document). The remainder of this document focuses on distinguishing and characterizing these two types of watercourse features.

DISTINGUISHING 'WATERCOURSE' FEATURES

Distinguishing geographic watercourse features within the Municipality as either streams or drainageways has substantial legal and economic significance. The classification scheme presented in this document incorporates specific defining criteria to aid in making defensible and reproducible identifications.

Characterizing constancy of flow is central to correctly classifying a watercourse as either a stream or drainageway. In general, *drainageways* include all surface water conveyances that transmit surface runoff from single storm events, or flows from highly localized snow melt, or flows from man-made drainage devices that intercept ground water. Except in the case of drainage devices that intercept ground water, flows along these conveyances are typically very brief. Note that drainageways may be natural features, such as a hillside swale or rill, or they can be man-made features, such as a ditch or a storm drain pipe. Thus, this classification recognizes two basic types of drainageways: natural, and constructed. A "natural" drainageway is a natural feature, such as a swale or rill, that serves to collect and direct ephemeral surface water flows. A "constructed" drainageway is any man-made channel or conduit designed to convey storm or other drainage waters.

Streams differ primarily from drainageways in that they typically transmit surface and ground water flows over some prolonged period of time. Flows over a "prolonged period of time" will generally (but not necessarily always) reflect contributions from runoff from multiple storm events, runoff generated from area-wide snow melt or other sources of prolonged snow melt, and ground water discharges. A "prolonged period of time" does not imply that a stream must have a continual flow. Streams for this classification reflect federal law in that they may be either "perennial" or "intermittent". Perennial streams have a continual (year-round) flow. Intermittent streams have flows that are either spatially or temporally discontinuous. "Temporally intermittent" streams typically have seasonal periods of flow followed by periods of no-flow—but when flow does occur volumes must still exceed that which would result from single storm events or from ground water flows induced solely from constructed drainages. "Spatially intermittent" streams may have sections along the stream alignment where flow is not present, either periodically or perennially. However all streams must display spatial continuity. That is, each uniquely identified stream feature must occupy a continuous line across which flow could occur (a 'topographic flow line') and where transmission of surface water either does or could take place. Finally, note that this classification does not include an "ephemeral" stream type. Under this classification an ephemeral surface flow feature is, by definition, a drainageway.

MAPPING AND CLASSIFYING STREAMS AND DRAINAGEWAYS

Designers, planners, regulators, maintenance staff and other users often require knowledge about the character of a stream or drainageway feature only along some small portion of the watercourse alignment and may thus tend to view watercourses—streams or drainageways—simply as a series of isolated pieces. Sound mapping and classification of watercourses requires a much more comprehensive viewpoint because of the spatial variability inherent in watercourse characteristics. The character of many attributes (e.g., width, depth, flow, intermittency) varies significantly along the length of each watercourse. In fact, stream and drainageway features are by their nature networks that can vary profoundly from place to place yet will still retain an overall physical continuity and character fundamental to the basic functionality of the watercourse system as a whole. Thus, a spatially wholistic approach to the identification and classification of watercourses that considers features as the sum of their parts (and not simply as a series of disassociated parts) is fundamental to the Municipal (and really any hydrologically-sound) philosophy of identification and classification of watercourses.

DEFINITIONS

Banks -A continuous, or nearly continuous, topographic feature characterized by an abrupt change in ground slope adjacent to, or near, a waterbody and separating the channel or basin of the waterbody from adjacent higher ground. Banks can be approximately located by observing the ordinary high water mark (often delineated by a demarcation between terrestrial vegetation and aquatic or no vegetation, or by distinct changes in soil horizons) as well as by visual delineation of the distinct topographic break near the waterbody. (Bradley et. al. 1990) One bank may be higher than the opposite bank.

Bed - The floors of water bodies. Beds are the solid materials, upon which stream water typically flows or lakes are confined, and which have spatially distinct characteristics of consolidation, composition, sorting, texture, and structure reflective of the watershed and the waterbody depositional regime. Beds may be demonstrated by observance of materials of a type and character typically formed by flowing water or stillwater features within a particular region. (AGI 1984)

Constructed - built, shaped, or otherwise substantially modified by humans; not the predominant result of natural processes or events.

Continual - uninterrupted in time.

Continuous - uninterrupted in space.

Channel - An open conduit either naturally or artificially created which periodically or continually contains moving water, or which forms a connecting link between two bodies of water. (Langbein et. al. 1983; Linsley, 1982)

Discharge Zone – Areas where there are upward components of hydraulic head in ground water (Fetter, 1980); areas where ground water exits to the ground surface in sufficient amounts to form either perennial or intermittent seeps and surface flows.

Drainageway - A watercourse that does, or under developed conditions is likely to, convey storm water flows. Drainageways are characteristically ephemeral, conveying flows only in direct response to storm water runoff and for limited durations. Drainageways may be identified along undeveloped land even if surface flows do not currently occur if it can be reasonably shown that constructed or natural drainageways likely will be required to convey storm flows, or will naturally develop, as a result of increased runoff due to anticipated future land development. Drainageways do not carry perennial flows except when these flows result from contributions from constructed subsurface or other human-induced drainage (e.g., foundation drains, or ditches or storm drains that intercept groundwater). Drainageways may exist naturally along topographic flow lines or they may be constructed.

Ephemeral flow - brief flow or presence of water in direct response to recent precipitation or highly localized snow melt. (AGI 1984)

Intermittent stream flow Stream flow that is not perennial or continuous but that, when occurring, still represents a volume greater than that from a single storm event. Thus, though the surface flow is discontinuous, the character of the source(s) of the periodic flow must imply the ability to sustain the flow

over a period of time. Examples of these types of sources include groundwater, wetlands, lakes and impoundments, and snow fields and areal snowpack. Intermittent stream flow occurs when:

- The flow does not occur continually (so that over some period of time flow may not be present), but at some time of an average year flow does occur and exceeds a duration solely attributable to a response to runoff from a single storm event and the flow is not solely the result of drainage construction, or localized snow removal or disposal activities.
- The flow does not occur continuously (so that at some point in time flow may disappear and reappear from place to place), but all surface flows do occur along a common topographic flow line and can reasonably be shown to be hydrologically related. Bed and banks may also be discontinuous along this type of intermittent stream.

Lake – any generally perennial body of inland, open, standing water which is not actively maintained for, or constrained to, a single specific human use (e.g., wastewater treatment ponds or flood detention ponds). An inland waterbody may serve some single, important human function (e.g., water supply) but to the extent that it is maintained to serve other functions as well (e.g., provision of fish and wildlife habitat and contact recreation opportunities) it will be identified as a lake feature under this classification. To the extent that a standing body of water is controlled for a single, limited human use (exclusive of contact recreation and open fish and wildlife habitat), it will be excluded from identification as a lake under this classification system.

Lake features may include expanded parts of rivers, reservoirs behind permanent dams, and basins seasonally inundated by intermittent stream flows. (AGI, 1984) Lakes, as defined here, include natural lakes, run-of the river lakes or impoundments, abandoned "gravel pit" lakes or other constructed lakes, reservoirs, and bog ponds and lakes.

Lake features are generally not distinguished by size in this classification system so that small inland waters more commonly referred to as ponds may be identified as 'lake' features here. However, by Municipal code any area of open water with a permanent minimum surface area at ordinary high water greater than 2,500 square feet is identified as a waterbody (Municipality of Anchorage, 1996) and features meeting this criterion and other criteria as defined herein will be identified as a lake under this classification. Nevertheless, in all cases a 'lake' is characterized by open water. Thus, standing water that exists solely amongst vegetation (e.g., as in a swamp, marsh or mire) does not comprise a 'lake' feature (Mitsch and Gosselink, 1993).

Natural - built or shaped for the most part by geologic, meteorologic, hydrologic or non-human biologic processes; not the predominant result of human intervention or activity.

Receiving Water - Surface water considered as waters of the U.S., including lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds.

Recharge Zone - Areas where there are downward components of hydraulic head in ground water systems (Fetter, 1980); areas where surface water tends to seep or percolate into the ground and does not resurface in the immediate vicinity, if at all.

Perennial stream flow – a stream flow that occurs throughout the year, except for extended periods of drought or cold.

Stream - a watercourse perennially or intermittently conveying waters not solely the result of constructed subsurface drainage. When a stream does flow it conveys more water than that contributed from a single storm event. In Municipal mapping each stream exists as a non-branched watercourse with only one

'headwater' source and one outlet or 'mouth', but any stream may have one or more tributary streams associated with it that contribute to its flow. A natural stream displays bed and banks except that these features may not be present locally where flow is intermittent (either spatially or temporally), or where the stream has been piped or otherwise substantially modified. Thus a stream retains its identity as a single continuous feature over its whole length even though its flow may periodically break up and disappear along its alignment. A stream's continuity from reach to reach is established through a reasonable demonstration of its actual or historic continuity of flow (perennially or intermittently) and its continuity along contiguous topographic flow lines. (Black 1979, Langbein 1960, Maidment 1992, Morisawa 1968, Anchorage Municipal Code)

Storm Water – flows originating from surface runoff of rainfall or snow melt.

Topographic Flow Line – a line of continuous fall in elevation across a land surface.

Tributary – a stream whose outlet is located along the course of another stream; a stream that flows into another stream.

Wetland – A landform feature so designated under the Anchorage Wetlands Management Plan. An area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas [cref Federal Clean Water Act, Section 404, Part 328.3, 7(b)] (Municipality of Anchorage, 1996).

Watercourse - a natural channel produced wholly or in part by the flow of surface water, or any artificial channel constructed for the conveyance of surface water. (AGI, 1984) Also any topographic flow line that either does, or under developed conditions is likely to, accumulate and convey substantial storm water flows. Also any conveyance, whether an open channel or closed conduit, constructed wholly or in part for the transport of storm water runoff. Watercourses include all surface water conveyance features and can be further classified under the Municipal classification system as either "streams" or "drainageways".

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