Waterbody Assessment
for
Jordan Creek
Juneau, Alaska

Prepared
for

City and Borough of Juneau
Engineering Department

Prepared
by

Carson Dorn, Inc.
712 West 12th Street
Juneau, Alaska 99801

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1 INTRODUCTION

In April 1998 the Alaska Department of Environmental Conservation (ADEC) placed Jordan Creek on the state's Section 303(d) List for impaired waters based on reported impacts to both water quality and fish habitat areas of the stream. As a result of the listing, the City and Borough of Juneau, under a grant from ADEC, contracted with Carson Dorn, Inc. to conduct a water body assessment of Jordan Creek. The purpose of the waterbody assessment is to gather data about the reported impacts, identify causes, and recommend solutions for improving the health of the stream.

This report begins with a discussion of the 303(d) process, followed by a presentation of the information gathered through the course of the assessment, including a history and description of development throughout the Jordan Creek watershed, summaries of available water quality and fish habitat data, identification of areas where both human and natural activities have caused changes and impairment to the stream, and concludes with a pollution control strategy.

In addition to the figures and tables found throughout the report, the following appendices have been included at the end of the document:

Appendix A References- Individuals and sources consulted while preparing the report, as well as pertinent documents reviewed;

Appendix B Photographs- Annotated photographs of key areas along Jordan Creek; and

Appendix C Support Documentation- A variety of water quality data referenced in the report.

2 REGULATORY BACKGROUND

2.1 303(d) Process

Section 303(d) of the Clean Water Act requires that the State of Alaska prepare and submit every two years a list of Tier I water quality-limited water bodies that require a comprehensive water body assessment. The purpose of the assessment is to verify the extent of pollution and to determine what controls are in place or needed for recovery. Water quality-limited waterbodies are surface waters with documentation of actual or imminent persistent exceedances of water quality criteria, and/or adverse impacts to designated uses as defined in the state's water quality standards. Designation of a waterbody as "water quality-limited" does not necessarily indicate that the entire waterbody is affected. In most cases, only a segment of the waterbody is affected.

The following guidelines are used by ADEC to determine if a waterbody is water quality-limited:

1. water quality monitoring data that documents persistent exceedances of a criterion or criteria established in Alaska's water quality standards;
2. issuance of a notice of violation or other enforcement action definitively linked to a persistent water quality violation that does not result in adequate corrective measures;
3. photographs or videos with appropriate documentation definitively linked to persistent exceedances of water quality standards;
4. documented persistent presence of residues (floating solids, debris, sludge, deposits, foam, scum) on or in the water, on the bottom, or on adjoining shorelines;
5. documentation such as a report or study within the last five (5) years that concludes designated uses are adversely affected by pollutant conditions; or
6. documentation from a resource agency professional or other credible source where the use of "best professional judgment" is applied to determine if a subject waterbody has persistent exceedances of water quality standards, may be subject to imminent criteria exceedances, or designated uses are adversely affected by pollutant sources.

Section 303(d) designated waterbodies are priority ranked into two tiers (Tiers I and II). Two additional tiers (Tiers III and IV) are for waterbodies that are not Section 303(d) listed. The following is an explanation of each tier category and its corresponding criteria.

Tier I: Water quality-limited waterbodies for which ADEC has documentation to indicate that the requirements of Section 303(d) list criteria are met. However, the waterbodies have not yet undergone comprehensive water quality assessments to: 1) verify the extent of water quality criteria exceedances; and 2) confirm that they cannot meet water quality standards under existing technology-based or similar controls by the next listing cycle.

Tier II: Water quality-limited waterbodies that meet requirements of Section 303(d), and have undergone comprehensive water quality assessments to determine the most effective methods for water quality restoration through the application of waterbody recovery plans.

Tier III: Water quality-limited waterbodies that are not Section 303(d) designated: They are water quality limited waterbodies that have an implemented waterbody recovery plan (such as an EPA-approved Total Maximum Daily Load (TMDL), or identified existing controls which provide ADEC assurances that water quality standards are likely to be met by the next listing cycle). These waterbodies are priority ranked and tracked by ADEC until state water quality standards are achieved.

Tier IV: Waterbodies that have been evaluated through the waterbody assessment process, and are no longer considered water quality-limited (nor 303(d) listed) and require no further action at this time. For the purpose of the waterbody assessment process, there is sufficient documentation the waterbody is no longer water quality-limited and the file will be closed. Tier IV waterbodies may be brought to ADEC's attention at any time for reevaluation.

2.2 Listing and De-listing of a Waterbody

Alaska's process for the "listing" of an individual waterbody to Section 303(d) designation begins with a review of existing and new information on open files within the department. These waters may be brought to the attention of ADEC by department staff, other state and federal agencies, industry, municipalities, Native organizations, environmental groups, and the concerned public. Once a waterbody has been placed on the Section 303(d) list, the process for "de-listing" a waterbody requires documentation that Tier III or Tier IV criteria have been met.

A completed water quality assessment on a Tier I Section 303(d) waterbody confirms the extent of impairment to water quality and/or designated uses. A comprehensive assessment requires the identification of pollution sources and corresponding pollutant parameters, and should result in one of the following:

- The assessment determines the waterbody is water quality-limited and that existing controls are inadequate to achieve water quality standards by the next listing cycle. The waterbody is placed on the Tier II list of Section 303(d) waters. Tier II Section 303(d) waterbodies require waterbody recovery plans.

- The assessment determines the waterbody is water-quality limited, but confirms existing controls are adequate to achieve standards by the next listing cycle. The waterbody is placed on the Tier III list.

- The assessment determines that the waterbody is not water quality-limited. The waterbody is placed on the Tier IV list of waters that require no further action at this time.

Tier II Section 303(d) waterbodies that have implemented waterbody recovery plans may be moved to the Tier III list. If monitoring determines that a waterbody on the Tier III list is not recovering, that water may be put back on the Tier II Section 303(d) list in the next listing cycle.

2.3 Jordan Creek and Section 303(d)

The Alaska Department of Environmental Conservation ADEC) placed Jordan Creek on the Tier I Section 303 (d) list in April 1998 stating that:

"This waterbody is placed on the 1998 Section 303(d) list for sediment, debris, and dissolved oxygen (DO) and has not occurred on any previous year's 303(d) list. Coho salmon have dropped from an average of 250 adult returns to 54 in 1996 and 18 in 1997. It has been one of the most productive small streams in Juneau and Southeast Alaska for Coho salmon but has experienced a rapid decline. There are serious sediment problems in the stream with poor survival of salmon eggs and low oxygen readings in the substrate that are in violation of water quality standards. The stream is largely spring fed and cannot transport large volumes of sediment like higher gradient systems. The headwaters of the stream have been manipulated with ditches replacing more productive habitat and with ponds being filled in. There is a problem with iron floc that was not present 10 years ago. The stream corridor is being rapidly developed and the lower section of the creek regularly goes dry. Insect sampling has shown the stream has low diversity and is experiencing declines over the 1994 to 1996 period."

3 JORDAN CREEK ENVIRONMENTAL SETTING

Jordan Creek flows along a north to south axis on the east side of the Mendenhall Valley (Figure 1). The creek is about 3 miles in length, ranging from 5 to 20 feet wide, 4 inches to 6 feet deep, with a low gradient and mild meanders throughout most of its length. The watershed totals about 1,700 acres or 2.60 square miles. The headwaters of Jordan Creek are spring fed from subsurface drainage off Thunder Mountain. There are two major tributaries at the source area, one along Thunder Mountain Trailer Court that is man made, and the other in a ground water seepage area a few hundred feet to the east. Jordan Creek traverses a mix of developed and undeveloped land. The east side of the creek from Egan Drive to the headwaters is mostly undeveloped forest interspersed with small wetland areas. The west side of the creek from Egan Drive northward is more developed with residential housing. South of Egan Drive, the creek has higher density residential and commercial development on both sides. Jordan Creek flows beneath the Juneau International Airport runway in a large diameter culvert, then on through the wetlands and tidal flat area, and finally discharges into Gastineau Channel.

Figure 1

3.1 Climate

Jordan Creek is located in the Maritime zone, characterized by moderate temperatures, significant precipitation and generally cool, wet conditions year round. Juneau International Airport (the nearest site with historical weather data) has an average annual temperature of 41 degrees, average annual precipitation of 53 inches, average annual total snowfall of 94 inches and a peak average snow depth of 18 inches. Frequent warming trends influenced by the maritime climate contribute to freeze-thaw conditions throughout the winter. The upper portion of the Mendenhall Valley (near the Jordan Creek headwaters) tends to have slightly less precipitation than the airport area.

3.2 Surface and Groundwater Hydrology

Like most of Southeast Alaska, surface water resources in Jordan Creek are influenced by the maritime climate of the northern Pacific Ocean and the Gulf of Alaska. Some of the world's highest runoff rates per unit of area can occur in Southeast Alaska. Jordan Creek has two seasonal periods with high runoff: a spring snowmelt period and a fall rainfall period. High water can occur throughout the year but the highest instantaneous peak discharges are more prevalent in the fall months. Low water periods tend to occur in late spring and mid summer.

For United States Geological Survey (USGS) water years 1997-2000, the annual mean flow in Jordan Creek was 8.65 cubic feet per second (cfs). The average annual runoff was 6,270 acre-feet. The 100-year flood flow at the mouth is estimated at 444 cfs as determined by the Corps of Engineers during a 1974 study to establish flood insurance boundaries. As improvements to the flood plain model are made, and a larger hydrology database developed, the predicted 100-year flood flow may be revised downward but only after a formal study is conducted.

A comprehensive evaluation of the groundwater resources along Jordan Creek has not been conducted to date. Water levels were measured intermittently in six wells along lower Jordan Creek in conjunction with a Duck Creek study of the interaction between groundwater and water in anadromous fish streams. For 2000, the water levels in the long term monitoring wells were within the range of historical values. The water levels in wells in the Jordan Creek watershed are closely related to the infiltration of rain and snowmelt and the level of water in nearby streams.

4 DEVELOPMENT HISTORY AND LAND USE

Prior to World War II, the area near the mouth of Jordan Creek consisted mostly of dairy farms. The airport, originally built in the 1930's and expanded during the war, altered the mouth of the creek to near its present location. Dairy farm property in the lower reaches of Jordan Creek above the airport area have been replaced by the largest concentration of commercial development outside of the downtown Juneau area, including the Nugget and Jordan Creek Malls, a number of two- and three-story office buildings, and many smaller commercial buildings and businesses. All facilities in this area typically have paved parking lots, though a few immediately adjacent to Jordan Creek are unpaved.

Clear-cut logging occurred on the east side of the creek in the early 1970s from approximately Nancy Street to Gail Street extending to the base of Thunder Mountain. Evidence of earlier logging is also evident in the higher reaches of the Jordan Creek watershed, near the headwaters.

The first subdivisions were developed in the valley in 1961. The population has increased from roughly 7,000 in 1967, to 10,000 in 1987, and to over 13,000 in 2001. The west side of Jordan Creek upstream of Egan Drive has residential development with a number of lots adjacent to the creek.

The following paragraphs describe the subdivisions starting at the upper portion of the watershed. See Figures 2 and 3 for details.

Figure 2

Figure 3

4.1 Tlingit-Haida Regional Housing Authority

This 20-acre, 50-unit subdivision on Kanat'a Street off the end of Threadneedle Street is located west and north of the headwaters of Jordan Creek. The subdivision was constructed in 1996. The street is paved with 14-foot travel lanes, concrete curb and gutter, and catchments and manholes to collect stormwater. The stormwater is collected and discharged from a storm drain at the south end of the subdivision into a 150-200' constructed channel that routes the water into a constructed ditch on the east side of Thunder Mountain Trailer Park. The channel is sloped and seeded to minimize erosion and maximize settling. A Notice of Intent for stormwater discharge and a Stormwater Pollution Prevention Plan for Construction was filed with the ADEC.

4.2 Proposed Thunder Mountain Trailer Park Expansion

An expansion of the Thunder Mountain Trailer Park was proposed in 1998. The project was found inconsistent with the Alaska Coastal Management Plan, however, the applicant proceeded with initial site preparation by logging about ten acres of land on the east side of the drainage ditch that runs south along the east side of the trailer park. The ditch intercepts groundwater and contributes to the headwaters of Jordan Creek. ADF&G indicated that a stream crossing was conducted without a Title 16 permit and requested that the work be stopped. The area has now been logged but no water, sewer, or roads have been constructed.

In 2000 CBJ applied for and received a Fish Habitat Permit (# FG98-I(J)-54) for stream channel modifications to improve drainage in the ditch, which had begun to fill in with sediment and be overgrown with vegetation. The Alaska Department of Fish and Game issued the Fish Habitat Permit on a design to improve the cross section, profile, and flow characteristics in this section of the creek.

4.3 Glacier Village Subdivision

This large subdivision is currently being constructed. It is located south of Valley Boulevard and consists of residential lots along Slate Drive, Canyon Drive, Dolomite

Drive, and Granite Drive. The lots on the east side of Granite Drive are near Jordan Creek. A drainage ditch (may or may not be cataloged as an anadromous stream) that starts on the east side of MPM pit is routed next to Granite Street and currently crosses through the lots on the east side of the street. The drainage is fed from upwelling from the MPM pit.

4.4 Coho Park

Coho Park apartment complex is located at the end of Amalga Street on the east side of Jordan Creek. There is a bridge crossing over the creek that also carries the sewer line. The complex consists of seven housing units with a paved parking area. Runoff from the parking area is collected in storm drains that discharge it into a grassy swale routed to Jordan Creek below the bridge.

5 Beneficial Uses

5.1 Water Use

Jordan Creek is used primarily for growth and propagation of fish and for recreation. Until the late 1990s groundwater was withdrawn from the lower portion of the creek for use as drinking water, however, the wells have been abandoned in favor of the municipal public water supply system. There is a Class A public drinking water well at Thunder Mountain Trailer Court with 67 service connections supplying about 150 people. The depth of the well is 60 feet.

DNR has issued several certificates of appropriation for subsurface water rights use in the Jordan Creek area. The appropriations are primarily for domestic use by homeowners. There is no information as to whether any of these appropriations are being used at this time.

There are no withdrawals for industrial purposes such as seafood processing or mining activities.

5.2 Fish Habitat

Jordan Creek has wild stocks of Coho and pink salmon, Dolly Varden and cutthroat trout. There is spawning and rearing habitat throughout the system. Adult Coho salmon generally enter Jordan Creek during high water periods in August through October with the peak returns in mid-September through early October. Coho spawn throughout the system. Coho fry will spend one to three winters in the creek before migrating out to sea as smolts in May and June.

Adult pink salmon enter into lower Jordan Creek between late June and mid August. Most spawning activity occurs in the intertidal zone. Out-migration of fry occurs in late winter and early spring.

Although adult cutthroat trout generally overwinter in lake systems, Jordan Creek has a resident population of fish that do not emigrate to salt water to overwinter. These fish prefer slow moving reaches and beaver ponds. Spawning normally occurs in May through early June in the headwater areas.

Adult Dolly Varden usually spawn in October and November with the hatch occurring in March. The young rear in the system for three to four years before migrating to sea in May and June. After spending the summer in the ocean, Dolly Varden find a lake system for overwintering. These fish will return to Jordan Creek during the following spawning season but will seek a lake system to overwinter after the spawning activity. Some resident populations of Dolly Varden never migrate from Jordan Creek.

5.3 Recreational Use

Jordan Creek has been closed to salmon fishing above the airport runway since 1983. The mouth below the runway receives some angling pressure for Coho.
Upper portions of the creek receive recreational use by children and some ATV use. In 1991, the Division of Sport Fish and the Juneau Department of Parks and Recreation built an aquatic educational boardwalk trail off the end of Jennifer Street. Many different

types of stream habitats such as pools and riffles, riparian vegetation, and wetland areas can be viewed from the trail.

6 FACTORS AFFECTING WATERSHED HEALTH

6.1 FLOODING (GENERAL COMMENTS)

Flooding is an environmental problem that is directly related to human activities. The magnitude and intensity of flooding are very much dependent on land-use practices in the watershed of Jordan Creek. It is important to understand the processes that influence flooding before any solutions to flooding problems are prescribed.

Floods occur when the amount of runoff originating in a watershed exceeds the carrying capacity of the natural and constructed drainage system. Periodic flooding can occur on Jordan Creek at any time of the year but most of the flooding events occur in the spring and fall. Flooding can occur as a result of rainfall or rainfall and snowmelt and can be due to river overflow or surface runoff.

The likelihood of flooding in an area can vary greatly based on: (a) the amount of runoff that results from rain in a watershed, (b) the water carrying capacity of a drainage basin, and (c) changes in land elevations with respect to riverbeds and sea level. Changes in these factors can increase flooding propensity in an area and flooding problems and solutions can be analyzed in the context of these three parameters.

Urbanization can intensify the flooding potential in a watershed. In an area with no development a greater lag time exists between intense rainfall and peak stream flow. After urbanization the lag time is shortened, peak flow is greatly increased, and the total run-off is compressed into a shorter time interval, creating favorable conditions for intense flooding.

The drainage capacity in the watershed must be adjusted to take into account the extra runoff that results from urbanization. The amount of adjustment needed in the carrying capacity of natural streams following urbanization depends on the degree of development. For a 10% increase in the amount of impervious surface in a watershed, a

23% increase in the drainage capacity is required. The lack of an efficient storm drain system can also contribute to the reduction of water carrying capacity.

Urbanization and deforestation makes the land surface more susceptible to soil erosion. Surface run-off can easily wash away the topsoil from disturbed areas. Eroded sediments can be deposited in creeks reducing the water carrying capacity and increasing flooding propensity. Streambed aggradation (filling in) contributes to the increased flooding propensity in lower reaches of urbanized streams. Soil erosion also reduces land elevations and increases elevations of riverbeds, contributing to increased flood depths.

Since land elevations are measured with respect to sea level, any change in the sea level causes land elevations to change as well. While sea levels are rising globally the Mendenhall flats are rising due to isostatic rebound. If sea level rises faster than the rate of land uprising then stream gradients are reduced. As a consequence, the river and stream discharge decreases, creating a backwater effect further inland. The backwater effect caused by sea-level change can result in more flooding of lands from "piled up" river water inland. This situation can be mimicked for short periods of time during extreme high tides.

6.2 FLOODING (JORDAN CREEK)

For Jordan Creek, the most frequent flooding occurs along the creek between Glacier Highway and Egan Drive along Cascade Street and Jordan Avenue. A flood occurred in this area over a period of several days in late December 1999 causing some property damage. The instantaneous peak flow on December 28, 1999, was measured at 149 cubic feet per second. Some concerns were expressed that the stream crossing under Glacier Highway contributed to the flooding problem. A review of the flooding downstream of Egan Drive was conducted by ADOT/PF in January 2001. Three conditions were identified that contribute to Jordan Creek flooding problems:

- A very flat drainage basin that does not promote efficient runoff,

- An inadequate channel to carry high flow events as a result of urbanization and stream encroachments (constrictions), and
- A channel that has become overgrown with weeds and willows, particularly downstream of Glacier Highway.

The review cited a number of conclusions regarding the flood problems in the area.

1. The two 8-foot diameter culverts installed in 1985 at Glacier Highway were designed to pass the 100-year flood and did not create a channel restriction.
2. Both the upstream and downstream areas of the channel (with respect to Glacier Highway culverts) have control sections that restrict the volume of flow and force water out-of-bank.
3. Changes to the downstream channel or to the culvert installation will not relieve the flooding situation unless the severe constriction at the Jordan Square building is eliminated. However, improvements downstream would certainly be a start in the right direction." (The constriction at Jordan Square is created by a combination of 90° bends (that route the channel around the building) as well as willows over hanging the banks.)

Glacial rebound may also have lessened the slope of the streambed in Jordan Creek below Glacier Highway near Lyle's Department Store and the Airport Mall. This has increased the retention time allowing the water to back up into developed areas where the flood plains have been constricted.

Due to the flat drainage basin Jordan Creek can be in a backwater condition during high flows up to the area near Gail Street. This contributes to minor flooding problems along Gail Street off Tongass Boulevard.

6.3 National Flood Insurance Program

Portions of Jordan Creek are managed by the Federal Emergency Management Administration (FEMA) under the National Flood Insurance Program (NFIP). Sections of Jordan Creek have been identified on Flood Insurance Rate Maps (FIRMs) as areas that would be inundated by a flood having a one percent chance of occurring in any given year (also referred to as the base flood or 100-year flood). Property owners within this area are required to purchase insurance protection against losses from flooding. Local insurance companies and lending institutions must provide the homeowners with the same standards and level of service as required for selling other lines of insurance.

The program allows the Federal Government to make flood insurance available only in those areas where the appropriate public body has adopted adequate floodplain management regulations for its flood-prone areas. The City and Borough of Juneau has adopted a floodplain management ordinance for this purpose. One of the provisions is a 50-foot setback requirement along streams. However, some developments prior to the institution of the 50-foot requirement may be grand fathered, and as a result, may be located within the setback requirement.

Several areas of flood hazard are commonly identified on the FIRMs. One of these areas is the special flood hazard area (SFHA), which is defined as the area that will be inundated by the flood event having a one percent chance of being equaled or exceeded in any given year. The one-percent-annual-chance flood is also referred to as the base flood or 100-year flood. SFHAs are labeled on the FIRM. Moderate flood hazard areas, labeled are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are also included on the maps. (See map in Appendix C)

FEMA has established administrative procedures for changing effective FIRMs based on new or revised scientific or technical data. A physical change to the affected FIRM panels and portions of the FIS report is referred to as a Physical Map Revision (PMR). A

PMR is an official republication of a community's NFIP map to effect changes to base (1-percent-annual-chance) flood elevations, floodplain boundary delineations, regulatory floodways, and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas, or correction to base flood elevations or SFHAs.

The City and Borough of Juneau has been gathering topographic information using an Airborne Light Detection and Ranging (LIDAR) system. LIDAR systems are airborne laser systems, flown aboard rotary or fixed-wing aircraft, that are used to acquire x, y, and z coordinates of terrain and terrain features that are both manmade and naturally occurring. The data gathered during the flights is used to create digital elevation models (DEMs) and digital terrain maps. These maps can be used in the PRM process to create new FIRMs, under the NFIP program.

6.4 WATER PASSAGE PROBLEM AREAS

One of the issues that stems from development in flood prone areas is adequate water passage. For lower Jordan Creek, where development has reduced the amount of wetlands that dissipate high flows, the adequacy of the culverts is frequently questioned. The culverts at Glacier Highway and Yandukin Drive have been sized to meet the 100-year flood when they were replaced in highway improvement projects. As no flood of this magnitude has occurred, there is little likelihood that any flooding in these areas is directly caused by the culverts.

However, when Egan Drive was constructed in 1973, the Jordan Creek culvert was not designed to withstand 100-year flood flows. Therefore, local flooding above the 100-year flood elevation could occur in this relatively undeveloped area.

A January 18, 2000 article in the Juneau Empire stated that a culvert under Egan Expressway near Fred Meyer is supposed to direct water from a Jordan Creek overflow ditch that extends west towards the Egan–Glacier Highway intersection. However, according to ADOT/PF the water along the Expressway is local runoff and does not receive Jordan Creek runoff.

The bike paths on both sides of Egan Drive can submerge when floodwater backs up in Jordan Creek.

A small bridge on the creek near the Jordan Creek Center has bridge stringers that can restrict high flows. There is another bridge at the end of Amalga Street that provides access to Coho Park, but no problems have been noted with water passage there.

A beaver dam on Jordan Creek near Gail St. reportedly contributed to flooding problems a few years ago. It's not known whether the dams are still active but they don't appear to be barriers to fish passage.

In October 1996, during the construction of the city's East Valley Reservoir, ADEC responded to a report of heavy turbidity in Jordan Creek below the Coho Park Bridge. The source of the turbidity was from scoured material from a rerouted tributary at the construction site. A large amount of deposition occurred downstream in the tributary with about 8 inches of fine silts on the banks of Jordan Creek. The siltation does not pose a barrier to fish passage but given the low gradient of the creek it may pose a threat to spawning gravel in adjacent downstream areas and increase the likelihood of flooding.

In general Jordan Creek lies at a higher elevation than Duck Creek and most of the drainages along the streets adjacent to Jordan Creek are routed to discharge into Duck Creek. See Figures 2 and 3 showing the drainage routes. Development in the valley has spread out from Mendenhall Loop Road, and given the topography, later subdivisions near Jordan Creek have been connected into the existing drainage systems. As a result there are very few water passage problems associated with stormwater into Jordan Creek.

6.5 LOW FLOWS

Jordan Creek has experienced historical low flow or no flow events in steam reaches below Egan Drive during extended periods of dry weather. Three recent events (June 1996 and May and September 1997) were documented above and below Glacier Highway; however, no fish kills were reported. A dissolved oxygen (DO) level of 6.5 mg/l was measured above Glacier Highway during the May 1997 incident. The DO standard is 7.0 mg/l or greater. A fourth incident occurred in September 1998 with significant number of dead Coho and Dolly Varden observed in reaches above Glacier Highway. The frequency of low flow and no flow conditions in the lower reaches appears to be increasing, although a specific cause or set of causes has not been identified.

6.6 GRAVEL EXTRACTION

Gravel extraction near the headwaters of Jordan Creek started in the early 1960s. The area was originally referred to as the Reid gravel pit. The property was sold in the late 70s and became known as the MPM pit. In 1981, a near-drowning incident occurred that resulted in a plan to fill in two large gravel extraction pits off of Valley Boulevard. The bulk of the infilling project lasted into the early 90s although some additional filling has occurred in recent years. While the infilling eliminated many of the physical hazards associated with the ponds some impacts to Jordan Creek remain, such as the discharge of water from an artesian spring in the pit, stream rerouting, and historic dumping of non-approved material into the ponds.

In 1983, ADEC documented that unsuitable material was being placed in the pit. In 1984, ADFG conducted site visits and issued a field report documenting household garbage, junked automobiles, and discarded equipment in the pit. A dark turbid runoff smelling of sulfur was observed discharging into a tributary of Jordan Creek. ADFG requested that the discharge be stopped. ADEC also documented water quality violations for turbidity and dissolved oxygen in the first couple hundred feet of Jordan Creek tributary below the discharge. A notice of violation was issued to MPM to stop the discharge and take steps to prevent the dumping of unsuitable fill material into the pit.

To address these concerns run off from the pit was channeled to Valley Boulevard and routed to Duck Creek through the drainage system along the city streets. CBJ later expressed concern that the rerouting to the Valley Boulevard drainage system was causing flooding problems during heavy rains. A larger culvert was finally installed on Valley Boulevard in 1986 to alleviate the problem.

In 1994, Miller Construction applied for a conditional use permit to use the site as a temporary storage yard. A grading permit was applied for in 1995 with a design that keeps the artesian flow from the site routed to Duck Creek. Specific details of the conditional use permit and the grading permit are still being worked out between the applicant and the city.

Presently storm water from the storage yard is routed to Duck Creek along Valley Boulevard. The artesian flow, located on the southeast portion of the yard, is routed to Jordan Creek through a ditch that runs parallel to Granite Drive. The discharge has a noticeable odor and very heavy iron precipitation. Granite Drive is under construction and the final layout of the ditch is not complete.

6.7 IRON OXIDE

When iron bacteria metabolize reduced-iron in the aqueous habitat, a brown slime (hydrated ferric oxide) precipitates out of solution. The result is often a reddish tinge to the stream bottom. Reduced-iron can be made available by disrupting groundwater flows that are naturally low in dissolved oxygen. Such disruptions often occur during clearing and grubbing, land filling, gravel extraction, and road construction activities. Iron precipitation in a stream can reduce interstitial gravel flows, reduce dissolved oxygen and can be an indicator that other parameters such as temperature, sediment loads, stream flow have been impacted.

The main source of iron floc in the upper reaches of Jordan Creek is from discharge from the MPM pit. Noticeable red staining of the stream bottom is present downstream of the confluence of the discharge. The highest dissolved iron content for Jordan Creek (4.9 mg/L) was measured in the tributary below the confluence.

7 WATER QUALITY CONCERNS

7.1 APPLICABLE WATER QUALITY STANDARDS

The water quality health of a stream is evaluated against water quality standards developed by EPA and ADEC. Water quality standards have been developed by these agencies for a variety of uses specific to water types (fresh vs. marine waters, etc.) Typically, the most stringent standards of all classified uses are applied to a water body in order to protect all uses. Table 1 below summarizes the water quality standards applicable to Jordan Creek.

TABLE 1
ALASKA WATER QUALITY STANDARDS
18 AAC 70

PARAMETER	STANDARD
Fecal Coliform Bacteria	Mean <20 FC/100 ml with not more than 10% samples exceeding 40 FC/100 ml
Dissolved oxygen	> 7, and not < than 5mg/l to a depth of 20cm in interstitial water of gravel
pH	Not < 6.5 or > than 8.5
Turbidity	May not exceed 5 NTU above natural conditions when the natural turbidity is 50 NTU or less.
Temperature	Many not exceed 20° C at any time. May not exceed 15° C for migration and rearing areas or 13° C for spawning and egg & fry incubation
Total Dissolved Solids (TDS)	TDS from all sources may not exceed 500 mg/l. Neither chlorides or sulfates may exceed 200 mg/l
Sediment	Percent accumulation of fine sediment in the range of 0.1 mm to 4.0 mm in the gravel bed may not be increased more than 5% by weight above natural conditions. In no case may the 0.1 to 4.0 mm fine sediment range in those gravel beds exceed a maximum of 30% by weight. In all other surface waters no sediment loads (suspended or deposited) that can cause adverse effects on aquatic animal or plant life, or their reproduction of habitat, may be present.
Toxic Substances	Substances may to exceed criteria in EPA Quality Criteria for Water or may not exceed the Primary Maximum Contaminant Levels of the Alaska Drinking Water Standards.
Color	May not exceed 15 color units or the natural condition which ever is greater.
Petroleum Hydrocarbons, Oils and Grease	Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 ug/L. Total aromatic hydrocarbons (TAH) may not exceed 10 ug/l.

Residues	May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, cause a film, sheen, or discoloration on the surface of the shorelines, cause leaching of toxic or deleterious substances, or cause a sludge, solid or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom or upon adjoining shorelines.

EFFECTIVE 5/27/99

7.2 AVAILABLE WATER QUALITY DATA FOR JORDAN CREEK

Much of the water quality data for Jordan Creek has been gathered by the U. S. Geological Survey (USGS), with a small amount gathered by ADEC. The USGS has established eight monitoring stations along Jordan and has collected water quality over various time periods, with some monitoring events dating back to the 1960s. Although many parameters have been measured over the years, not all have been consistently measured at each site. Among the wide variety of parameters measured are temperature, flow, pH, nitrogen, phosphorus, sediment, turbidity, dissolved oxygen, and chemical data for inorganic and organic constituents. The following paragraphs describe USGS monitoring locations, discuss water quality data gathered by the USGS and ADEC determined to be pertinent to this assessment, and summarize the USGS data tables that have been included in Appendix C.

Under an affiliated portion of the water quality grant from ADEC, water quality data on four streams including Jordan Creek was collected during a period from March 27 to June 18, 2002. Three monitoring sites on Jordan Creek were sample six times during the period. Field parameters for turbidity, pH, conductivity, temperature, dissolved oxygen, and flow rates were collected. Fecal coliform samples were collected for laboratory analysis. Because of the unusually dry weather this spring the water quality data is representative of low or moderate flows. The sampling data is discussed fully in the *Stormwater Sampling Project Summary Report, June 2002*. A summary table of the monitoring results for Jordan Creek is included in Appendix C

7.2.1 USGS Measurement Sites

The USGS has six sites along Jordan where it gathers information about discharge rates and water quality data. The data are usually collected on a one-time basis, but sometimes additional measurements are collected on a random or discontinuous basis. The sites are shown on Figures 2 and 3 and include:

- Jordan Creek at Thunder Mountain Trailer Park
- Jordan Creek at Valley Street
- Jordan Creek at Amalga Street
- Jordan Creek at Jennifer Street
- Jordan Creek at Nancy Street
- Jordan Creek below Egan Drive
- Jordan Creek on old Glacier Highway
- Jordan Creek above Yandukin Avenue

In addition to these sites, a USGS gauging station is located below Egan Drive near the Super 8 Motel and consists of a water stage recorder for a period of record from May 1997 to the present providing daily and monthly mean discharge in cubic feet per second. A staff gauge and crest gauge are also installed near a fish weir located below Yandukin Drive at the Juneau International Airport.

7.2.2 Water Quality Data

7.2.2.1 Dissolved Oxygen

The USGS has documented exceedances of the water quality standard for Dissolved Oxygen at the Jordan Creek Tributary at Valley Boulevard site, and Jordan Creek below Egan Drive. ADEC has monitored Jordan Creek in response to reports of floods, low flows, and fish kills. They have measured Dissolved Oxygen exceedances in a pool above the Glacier Highway culvert during a low flow event.

The National Marine Fisheries Service has reportedly measured Dissolved Oxygen in interstitial gravels in Jordan Creek. This information has been cited by several resource agencies during the listing of Jordan Creek as a water quality limited waterbody. Unfortunately, the data has not been published and could not be obtained for this report. As a result it is not possible to compare the data to the water quality standard for sediment.

7.2.2.2 Temperature

USGS documented an exceedance for temperature at the Amalga Street, Nancy Street, and Old Glacier Highway locations during a July 1999 sampling event.

7.2.2.3 Turbidity

One turbidity violation is on file with ADEC for Jordan Creek for February 8, 1991, at the Yandukin Drive Culvert.

7.2.2.4 Calcium Carbonate

Most streams in Alaska above tidal reaches contain calcium carbonate generally less than 200 mg/L. Jordan Creek typically has an alkalinity as measured by $CaCO_3$ in the 40-60 mg/L range. Water hardness generally increases with the increased dissolved solids content.

7.2.2.5 Suspended Sediment

For non-glacial streams such as Jordan Creek the suspended sediment concentrations seldom exceed 100 mg/L. These streams normally transport the greatest sediment loads during spring break up or during period of high rainfall. The USGS has measured suspended sediment at miscellaneous sites; however, the ADEC Water Quality Standard for sediment is measured by the percent accumulation in the gravel bed.

7.2.2.6 Organic Compounds

In 1984, the U.S. Fish and Wildlife Service, Resource Contaminant Assessment Program collected Coho salmon from Jordan and analyzed them for the organochlorines DDT, DDE, DDD, polychlorinated biphenyls (PCB) and total phenols. Concentrations of DDD, DDT and total phenols were below the detection limits. DDE and PCB were found at trace levels of 0.01 and 0.03 ppm respectively.

7.2.2.7 Insect Diversity

Although not a direct measurement of water quality, insect diversity is often used as an indicator of water quality health of a water body. In 1995, a study of rapid bioassessment protocols was conducted on Duck Creek, with data collected at control sites along Jordan Creek. The purpose of the study was to evaluate the use of rapid assessment protocols as a means to develop baseline information for future restoration projects. Four protocols were evaluated; Percent Dominant Taxa (DOMTAX), Number of EPT Genera (Ephemeroptera, Trichoptera, and Plecoptera) (EPT GEN), EPT Individuals/Total Individuals (EPT/TOT), and Family Biotic Index (FBI). Two control sites were selected on Jordan Creek; Site 1 was located at Totem Park Drive and Site 2 near the Super 8 Motel. (The location of Site 1 could not be verified during the this assessment.) Six sampling events were conducted from June 13, 1994, to November 4, 1996. The study concluded that Site 1 might not be a good reference site as the evaluation metrics indicated some impairment. The values for EPT/TOT, DOMTAZ and FBI for Jordan Creek were <0.50, 40%, and 3.8 respectively. These metrics were compared to an unimpaired stream in an Anchorage area where the metrics were >0.82, 15%, and, 3.95.

7.2.2.8 Fecal Coliform

The only fecal coliform data available for Jordan Creek are the data collected in May and June 2002. The data were collected in a separate phase of work under the ADEC grant. Five out of five sample results showed exceedences above the water quality standards at the Jordan Creek Bridge near Jordan Creek Center. Four out of six samples showed exceedences at the site above Egan Drive and four out of five at the Amalga Street site. The data gathered represent low and medium flow conditions.

7.2.3 Water Quality Data Summary

In general, while a wide variety of environmental and water quality data has been collected for Jordan Creek, the data is not consistent for specific sites, does not represent water quality conditions throughout an annual period (month-by-month), does not provide background measurements for comparison, and was not consistently gathered for the same parameters. As a result, meaningful comparisons of the data are difficult. Table 2 represents an accumulation of data gathered by USGS and ADEC where parameters monitored were the same or comparable. Figure 1 shows the monitoring locations or stations along Jordan Creek that are referenced in the table.

Table 2

7.3 Fish Escapement Surveys for Jordan Creek

ADFG has conducted peak survey counts (highest of the season) for adult Coho salmon every other year since 1981. The surveys are conducted by walking the creek from Thunder Mountain Road to the ponds along Yandukin Drive across from Ward Air. The counts are an index of escapement meaning that the peak counts represents about 20% of the total escapement. The peak survey counts have ranged from a high of 785 in 1991 to a low of 47 in 1999.

In 2001, the ADFG peak survey index count was 119 Coho, yielding an estimated total escapement of 595. During the same year, a salmon weir was installed on the creek within the Juneau International Airport boundary as part of an Environmental Impact Statement fishery study for runway safety and airport development. The weir was operated from September 8 through November 6, 2001, and yielded a total weir count of 525 adult Coho salmon. The airport weir information confirms that the peak survey estimates of 20% used by ADFG to determine total escapements is a valid method to estimate total escapement.

The ADFG data for Jordan Creek is presented in Table 3 with data for other streams for comparison. The information is illustrated graphically in Figure 4. Jordan Creek smolt counts through the weir at the airport are shown in table 4.

Table 3

ADF&G Sportfish Division

Peak Survey Counts 1981-2001

Comparison by stream

Year	Jordan Cr	Montana Cr	Peterson Cr	Steep Cr.	Switzer Cr.
1981	482	227	219	515	109
	368	545	320	232	80
1983	184	636	219	171	80
	251	581	189	168	123
1985	72	810	276	186	122
	163	60	397	250	54
1987	250	314	204	128	48
	215	164	542	155	51
1989	133	566	242	222	78
	216	1711	324	185	82
1991	322	1415	410	267	227
	785	2515	403	612	93
1993	322	1352	112	471	94
	371	1829	318	200	198
1995	77	600	280	409	42
	54	798	263	134	42
1997	18	1018	186	182	67
	63	1160	102	149	42
1999	47	1000	272	392	51
	30	961	202	88	50
2001	119	1119	106	366	50

Figure 4
Mendenhall River Coho Salmon
(Peak Counts in Index Areas vs. Jordan Cr.)

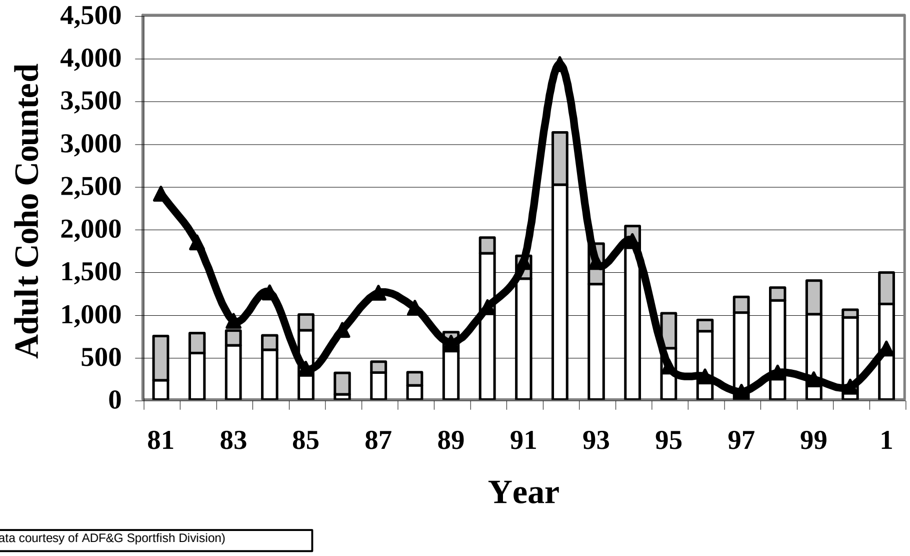

Table 4
Jordan Creek Smolt
Weir Counts
2001

Species	Smolt Count
coho salmon smolts	26,607
cutthroat trout	110
Dolly Varden smolts	204
chum salmon fry	4,637
Coastrange Sculpin	262
stickleback	94

NOTES

* The sea-run cutthroat trout were both smolts and over-wintering adults.
* The chum salmon fry count is not a complete count as they are very small and The trough design allowed for many to pass through the structure and hence were not captured in the live box.
* No pink salmon fry were captured but they would have out-migrated prior to the trap becoming operative.
* The weir began fishing in late April, on about April 25.

8 POLLUTION CONTROL STRATEGIES

8.1 Introduction

A variety of pollution control strategies are available that might improve the quality of the Jordan Creek system. These include:

- Develop a waterbody recovery plan that uses existing controls and resources to sustain water quality.
- Develop a waterbody recovery plan that uses new controls to sustain water quality.
- Establish a Total Maximum Daily Load (TMDL) for the watershed to establish the maximum amount of pollution Jordan Creek can assimilate without violating state water quality standards.

The following paragraphs provide additional information about each strategy.

8.2 Existing Controls

Developing a waterbody recovery plan using existing controls will require the implementation of core permitting and restoration programs to maintain water quality and conserve natural resources. Existing regulations, ordinances and best management practices would be applied. It would require increased coordination and information exchange among regulating agencies, the City and Borough of Juneau, and developers. A good example of this is the need for better salmon cataloging information on tributaries to Jordan Creek.

8.3 New Controls

Developing a waterbody recovery plan that uses new controls to sustain water quality recognizes that new technology and best management practices (BMPs) are available for assessing and controlling the impacts of development in the Jordan Creek watershed. In order to predict the water quality impacts of future development a comprehensive stormwater modeling package could be used to analyze urban drainage systems, stormwater sewers, and sanitary sewers. The model could combine hydrology, hydraulics, and water quality information into the decision making process.

To mitigate impacts to the stream from flooding and to improve the quality of stormwater runoff additional BMPs in road construction, subdivision development, land use planning, and water resources management, should be considered. The BMPs pertaining to flood control are those activities that will help reduce the run-off, increase the carrying capacity of the drainage system, and increase land elevations with respect to sea level or streambed. BMPs to reduce flooding in Jordan Creek can include the following features and activities:

- dredging of stream channels and filled-in areas,
- sizing of ditches and culverts to store larger volumes of runoff
- re-excavation of abandoned channels and ponds,
- maintaining and establishing vegetated buffer zones along the creek,
- putting silt fences around construction sites,
- building sediment retention ponds in construction sites,
- building water detention ponds in subdivisions,
- designing and maintaining efficient storm sewer systems,

As an example CBJ might consider requiring contractors and owners to grade sites or locate buildings to incorporate detention ponds in new developments. Increased stormwater runoff resulting from the proposed development could thus be partially mitigated by providing new detention storage. To decrease site runoff, perhaps roof drainages could be diverted to the new detention ponds, rather than directly to the stream or storm drainage system. There may be a way to include vegetated swales in developments without reducing the number of parking spaces on a site. There may be a way to use streets for temporary storage of stormwater runoff, through proper design and the use of sanitary sewer manholes that prevent the infiltration of the ponded water.

8.4 Total Daily Maximum Load (TMDL)

A TMDL allocation strategy requires the development of high quality critical data elements that would allow TMDLs to be developed and justified. Data development plays a major role here and requires a significant investment of resources. The resulting

TDML would be based on solid science and would strictly control negative impacts on the stream.

9 CONCLUSIONS

Jordan Creek will no doubt continue to undergo changes as the demand for developed property continues. As of now viable fish populations are coexisting with human populations. What will be the condition of the creek in 20 years? The answer to that question lies in how water quality issues stemming from increased development are resolved. Much can be done to maintain and enhance the creeks natural ability to store, treat and discharge runoff. Achieving this will take a coordinated effort between CBJ, property owners, resource agencies, Mendenhall Watershed Partnership and the general public.

The following paragraphs highlight some the issues with water quality data that need to be addressed.

9.1 Weak Water Quality Data

While there is little doubt that Jordan Creek has suffered some impacts by virtue of being an urban stream, the existing science has not clearly established what issues need to be addressed. Our review suggests that existing water quality information is not adequate to document a persistent exceedance of a criterion established in the water quality standards. Examples of weaknesses in the data are presented in the following paragraphs.

Some exceedances for dissolved oxygen have been measured by USGS in conjunction with summer low flow events in the Valley Boulevard, and below Egan Drive but the data are not comparable to the water quality standard which requires measurement of dissolved oxygen in interstial gravel. Some exceedances for dissolved oxygen were also documented in the MPM pit in 1984 when the pit was being filled but this data is outdated now that the pit is filled and interstial gravel levels were not measured.

Only one copy of a Notice of Violation (NOV) issued for activities on Jordan Creek could be located in agency files. Letter reports in the record do, however, refer to NOVs that were issued for construction activities at the MPM pit and for stormwater runoff at the Glacier Highway culvert in the mid 1980s. Factors that precipitated the NOVs were problems at MPM pit and the maintenance and operation of stormwater drainages after the reconstruction of the Glacier Highway crossing.

The Insect Diversity Study suggests some impairment of Jordan Creek. This conclusion is based on an evaluation of the results of a rapid bioassessment protocol at a control site on Jordan Creek near Totem Park Drive. Unfortunately, the referenced street name does not exist so the location of the control site cannot be verified.

Some agencies relied on other agency data to support a request to list Jordan Creek as an impaired water body. In a few cases the information was derived from unpublished data that could not be evaluated.

9.2 Pollution Control Strategies

Because the data do not illuminate a well-documented water quality issue for Jordan Creek, it is difficult to recommend aggressive new control strategies. Nonetheless, it is clear that the preservation of Jordan Creek and its salmon run is a worthwhile endeavor. Probably the most reasonable, but still responsible approach would be to hone "existing controls and resources". This would ensure the existing controls available through the various permit processes are implemented and monitored for maximum effectiveness. It would also help to develop a cohesive picture of the stream condition. This would require coordination among the various agencies to implement such an effort. Funding might come from a number of sources to ultimately develop a cohesive picture of Jordan Creek.

As part of the initial stage of "getting organized", certain issues that emerge might be targeted for action. One such issue might be the discharge from the east side of the old

MPM pit. This discharge is currently entering Jordan Creek below Granite Drive and is contributing to the iron flocculation and turbidity in the creek. It is feasible to route the discharge to Duck Creek through the Valley Boulevard drainage system, however, this action would have to be evaluated in terms of impacts to Duck Creek before it is implemented.

Once a clearer image of Jordan Creek's condition begins to emerge, then it might make sense to move on to the development of a comprehensive stormwater modeling package. Then the relationships between storm duration, intensity and pollutant discharge can be used to develop simple watershed scale models that can predict flow and pollutant discharges from drainage systems and can be used to simulate and optimize management techniques. However, the generation and the transport of pollutants in urban systems during a storm event are very complex because they concern a number of transport mechanisms and many space and time scales. This tendency towards complexity makes stormwater models difficult to put into operation. Typical problems areas for such modeling include 1) doubtful mathematical formulation of processes, 2) uncertainties on input and calibration data, and 3) difficulties and cost of calibration. Software packages are available for such modeling and they are always improving but procuring and using such packages represents a significant financial commitment so it is not something to be undertaken lightly.