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STATUS OF HYDROGEOLOGIC WORK NEAR POTTER MARSH WITH SUGGESTIONS FOR FUTURE WORK

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INTRODUCTION

Potter Marsh is an important and heavily used wildlife habitat area in South Anchorage, in close proximity to Alaska's largest population center. Increasing development in the Potter Marsh watershed has raised numerous concerns about the future integrity of the marsh as a wildlife habitat area. Additional concerns have been expressed over the proper management of adjacent water resources to serve a growing population in the area. Specifically, the following concerns are commonly mentioned:

1. Urbanization may result in the transport of oils, greases, salts, nutrients, other contaminants, and excessive amounts of sediment into the marsh.

2. Urbanization may significantly alter the timing and duration of flows to the marsh, with direct impacts on resident or migratory fish and wild fowl.

3. Development of a storm water drainage system may result in the diversion of water away from the marsh, and cause shallow ponds to turn into mud flats.

4. Numerous residential septic systems provide shallow groundwater recharge yet may cause groundwater seeps (and icings) or groundwater contamination, depending on site conditions.

5. Extension of public sewers to the area may result in significant reductions in groundwater replenishment, with impacts on the marsh.

6. Development of water wells in the basin above Potter Marsh may result in lower water levels and:

    a. conflicts over domestic water supplies, and

    b. a decrease in groundwater flow to the marsh, with impacts on the marsh.

With the awareness of these potential problems, steps have been taken to collect hydrologic information in and near Potter Marsh. The information already collected has been sufficient to allow more precise

delineation of potential problems than has heretofore been possible. The objectives of this report are to outline recent hydrologic findings, to point out issues that may be critical to future management of the area, and to suggest a series of tasks that would address important issues.

FIELD OBSERVATIONS

Field observations indicate that tidal flooding of Potter Marsh occurs regularly during periods of high tides, but is limited to a relatively small area around the culverts that constitute the sole outlet of the marsh. Other observations suggest that water in the ponds at the south end of the marsh flows to the north, vitually independently of the stage (or flow rate) of Rabbit Creek and Little Rabbit Creek. Of a total marsh area of about 450 acres, 78 percent of the marsh, or 350 acres, is outside of the main Rabbit Creek and Little Rabbit Creek drainages. This portion of the marsh, which contains most of the open water ponds used by birds, is sustained by precipitation directly onto its surface and from surface and groundwater inputs from a 2.5 square mile drainage basin between the Little Rabbit Creek and Potter Creek basins (fig. 1). This small basin is drained by an unnamed creek and several intermittent streams that currently discharge into Potter Marsh. The basin supplying water to the south 350 acres of Potter Marsh will be referred to as the South Potter Marsh basin in this report.

POTENTIAL PROBLEMS

The Municipality of Anchorage is currently initiating a storm drainage master plan study in South Anchorage, including the South

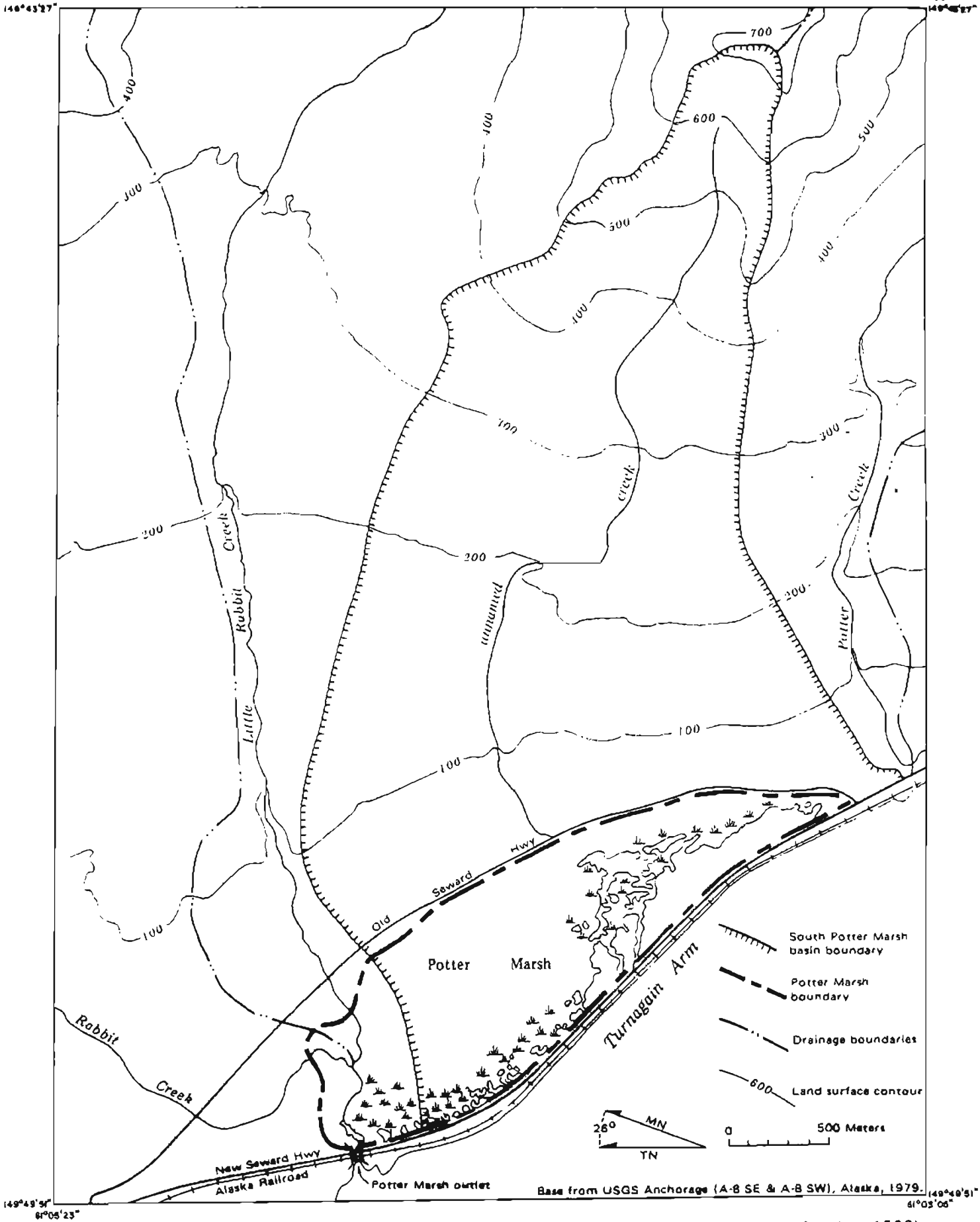

Figure 1. Delineation of South Potter Marsh basin boundary(modified from Emanuel and Cowing, 1982).

Potter Marsh basin (Tom Bacon, Municipality of Anchorage, personal communication, 1984). Principal design parameters are peak flood flows, location of system outfalls, and treatment of contaminated runoff. The physical setting of the South Potter Marsh basin presents an interesting dilemma. If runoff from the basin is directed into the marsh, the water quality of the marsh may be significantly affected by an influx of urban-generated contaminants. On the other hand, if runoff from the basin is diverted around the marsh, water levels in the marsh may drop significantly because of the aforementioned dependence of 78 percent of the marsh on the basin. Numerous shallow ponds in Potter Marsh are susceptible to shrinking or disappearing if water levels drop significantly.

Furthermore, the Anchorage Water and Wastewater Utility (AWWU) currently has plans to extend public sewer to the South Potter Marsh basin several years in advance of public water service (Lou Bonito, AWWU, personal communication, 1984). The potential exists for a sewer system to remove significant amounts of water from the basin and contribute to a decrease in water availability for marsh recharge and increasing public water demand.

DATA COLLECTION ACTIVITIES

Currently, the USGS operates continuous gages on Rabbit Creek and Little Rabbit Creek, maintains precipitation stations in the area, periodically observes staff gages in the Marsh, periodically measures surface water flow from the South Potter Marsh basin, and collects water-quality data in the area (Tim Brabets, USGS, personal communication, 1984).

The U.S. Fish and Wildlife Service (USFWS) has initiated a program of water-quality monitoring that focuses on trace metals and other potential contaminants (Pat Wennekens, USFWS, personal communication, 1983). The USFWS program includes monitoring the unnamed creek draining the South Potter Marsh basin.

DGGS has initiated a bid procedure to drill nested observation wells (wells of different depths at the same location) near the junction of the Old Seward Highway and the unnamed creek. The above-mentioned projects constitute the essence of an integrated, cooperative, field data collection program for the Potter Marsh area. Analysis and publication of new and historic data will be carried out cooperatively by the participating agencies.

UNRESOLVED ISSUES

As previously discussed, the South Potter Marsh basin is critical to the support of Potter Marsh. Observations to date suggest that groundwater and surface water are closely related in the basin, and that both hydrologic components are important contributors to the marsh. Quantitative estimation of these components is an important step in resolving the concerns discussed previously in this report. Unfortunately, the existing data base, together with currently funded data collection activities, will result in crude, quantitative estimates because certain fundamental technical questions cannot be adequately answered. Some of these questions are:

1. How does the unnamed stream respond to precipitation events?

2. What is the relative importance of groundwater flow through bedrock fractures versus flow through glacial deposits in the area?

3. How much groundwater discharges to Potter Marsh and how much discharges directly to Turnagain Arm, considering a range of hydraulic properties for both bedrock and glacial sediments?

Other, more practical questions, are likely to be even more difficult to answer:

1. What will be the effect of diverting a given amount of surface runoff away from Potter Marsh?

2. What will be the effect of extracting increasing amounts of groundwater from deep (>200 feet) parts of the flow system?

3. What is the chemistry of surface- and groundwater?

4. What will be the effect of urbanization on rates of groundwater recharge?

PROPOSED WORK TASKS

The most feasible way to provide suitable answers to the questions listed above is through an intensive data collection and analysis program in the South Potter Marsh basin. An enumeration of work tasks that would provide technical input to the complicated processes of land development and water management is given below:

1. Using existing well-log data as a guide, a network of 15-20 deep soil borings drilled by a truck-mounted auger rig would allow characterization of the subsurface glacial geology as it relates to the known surficial geology (Schmoll and Emanuel, 1981). Installation of piezometers would allow monitoring of water levels and hydraulic testing of geologic materials.

2. Installation of three to six bedrock piezometer nests would allow testing of the hydraulic parameters of the fractured bedrock system and provide information on the behavior of the bedrock flow system.

3. Installation of a continuous gage on the unnamed creek would provide important information on the response of the basin to precipitation events and allow quantification of basin runoff.

4. Application of a mathematical model to simulate the groundwater flow system in the South Potter Marsh basin would facilitate estimation of groundwater discharge rates to Potter Marsh and the estimation of water-level changes in response to local pumping.

5. A surface- and groundwater quality sampling and analysis program would provide baseline information and allow assessment of the effects of urbanization on local water quality.

The estimated time for completion of the work tasks is 2½ years from July 1, 1984.

References

Emanuel, R.P., and Cowing, D.J., 1982, Hydrogeology for land use planning: the Potter Creek area, Anchorage, Alaska: U.S. Geological Survey Water Resources Investigation Open-File Report 82-86, 4 sheets.

Schmoll, H. R. and Emanuel, R.P., 1981, Geologic Map with hydrologic properties of materials, Potter Creek area, Anchorage, Alaska: U.S. Geological Survey Open-File Report 81-1168, scale 1:25,000.