Exxon Valdez Oil Spill
Restoration Project Final Report

Mitigating Stormwater Runoff in Cordova Through Snow Management Analysis

Restoration Project 15120112-C
Final Report

Kristin Carpenter

Copper River Watershed Project
P.O. Box 1560
Cordova, AK 99574

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Legacy of the *Exxon Valdez* Oil Spill: Mitigating Stormwater Runoff's Chronic Toxicity Through Snow Management Analysis in Cordova

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Study History: Stormwater runoff was identified as a pollutant in Cordova from testing conducted by the Copper River Watershed Project (CRWP) in collaboration with NOAA's Auke Bay Laboratory (Short et al., 2006). From 2008 – 2012, the CRWP commissioned a series of reports on stormwater pollution in Cordova. Each of those reports specifically recommended developing and implementing a snow management plan for Cordova. Snow disposal is a form of nondomestic wastewater (ADEC 2009a, 2009b, in Jacobs Engineering, 2009). Long-term research conducted as a result of the *Exxon Valdez* oil spill has documented that chronic pollution, such as stormwater pollution, has harmful effects in marine environments (Peterson et al., 2003). The CRWP was concerned about snow storage immediately adjacent to Eyak Lake, Odiak Pond, and Orca Inlet receiving waters, which host sockeye and coho salmon and herring, which is a species listed as "not recovering" in the "*Exxon Valdez* Oil Spill 2014 Update: Injured Resources and Services" (November, 2014).

Abstract: The Copper River Watershed Project designed this project to analyze City of Cordova and Alaska Department of Transportation & Public Facilities' practices for snow handling and storage, to make recommendations for changes that would reduce pollutants draining to receiving waters, to implement best management practice site improvements at up to three snow storage sites in Cordova, and to measure differences in water quality of snow meltwater before and after implementation of best snow management practices. Because synthesized research on the long-term effects of the *Exxon Valdez* oil spill found that chronic persistence of oil has sub-lethal impacts on marine populations, the Copper River Watershed Project was concerned about the effects of stormwater runoff (including melting snow) on sockeye and coho populations in Eyak Lake, coho salmon in Odiak Pond, and juvenile herring in eastern Prince William Sound. Due to unusually low amounts of snowfall during the winters of this grant period, we were unable to sample snow meltwater runoff. We did complete a municipal and state snow handling practices analysis, improve one snow storage site and complete design of a second, and produce a snow storage guidance document for use by municipalities and state agencies.

Key words: Best Management Practice (BMP), bio-filtration, polluted meltwater drainage, snow handling and storage, snow meltwater, stormwater runoff, water quality.

Project data: Products of this effort include the three documents submitted with this report. In addition, two sets of engineer's design drawings were produced for use in creating snow storage site Best Management Practice (BMP) improvements at two Cordova snow storage sites.

Citation:

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I. Executive Summary

Small coastal communities in Alaska are not subject to permitting requirements for the discharge of stormwater runoff, including snow meltwater, into sensitive aquatic and marine environments. Yet research following the *Exxon Valdez* oil spill documented that "hydrocarbons . . . from partially weathered at concentrations as low as 1 [part per billion] are toxic to pink salmon eggs exposed for the months of development and to herring eggs exposed for 16 days" (Marty et al., 1997 and Heintz et al., 2001 in Peterson et al., 2003). The EPA considers non-point source stormwater run-off to be among the leading contaminants degrading water quality in the U.S. today (EPA, 2003).

The Copper River Watershed Project worked to demonstrate that application of Best Management Practices (BMPs) to managing snow in a developed community improves the water quality of snowmelt discharges that flow directly into Orca Inlet, the habitat range of the majority of PWS juvenile herring (S. Pegau, personal communication, June 2013). Our objectives for this project included:

(1.) Analyze City of Cordova and Alaska Department of Transportation & Public Facilities (ADOT/PF) snow management practices & make recommendations to reduce snow meltwater pollution being discharged into aquatic and marine environments;
(2.) Implement Best Management Practice (BMP) filtration structures at up to three sites around Cordova for filtering snow meltwater.
(3.) Monitor snow meltwater runoff water quality before and after implementation of BMPs.
(4.) Synthesize results on the effectiveness of BMPs (maintenance required, results of water quality monitoring) and the cost-effectiveness of each approach applied with regard to water quality improvements in a BMP guidance report for distribution to small, coastal municipalities.

A partnership planning team with staff from the City of Cordova, ADOT/PF and the CRWP was formed to facilitate the snow management practices analysis and reports prepared by contract engineer DOWL. The engineers made two site visits to interview staff and collect data, and review site conditions at locations identified for snow meltwater treatment structures. The CRWP also made an effort to circulate information about snow meltwater and other forms of stormwater pollution to community leaders, homeowners (for fuel tank maintenance), pet owners (for proper pet waste disposal), and drivers (for vehicle fluid leaks).

DOWL Engineers produced two reports for this project. The first is an analysis specific to the Cordova community's snow management practices and opportunities for improving handling of snow in ways that reduce snow meltwater pollution to receiving waters. The second report is broader and designed to be a planning guide for coastal Alaska communities in conducting their own evaluations of how to reduce snow meltwater pollution.

Based on site selection recommendations and City of Cordova collaboration, DOWL also designed snow storage improvement BMPs at two snow storage sites. Improvements were constructed at one of these sites in July, 2015 and site and drainage improvements will be constructed at the second site in 2016 with funding from the National Fish & Wildlife Foundation.

The sequence of steps followed for assessing Cordova's snow management practices and opportunities for reducing snow meltwater pollution can serve as a model for an integrated, community planning effort to reduce stormwater runoff pollution. Other small, rural Alaska communities can conduct a similar evaluation by gathering the following information:

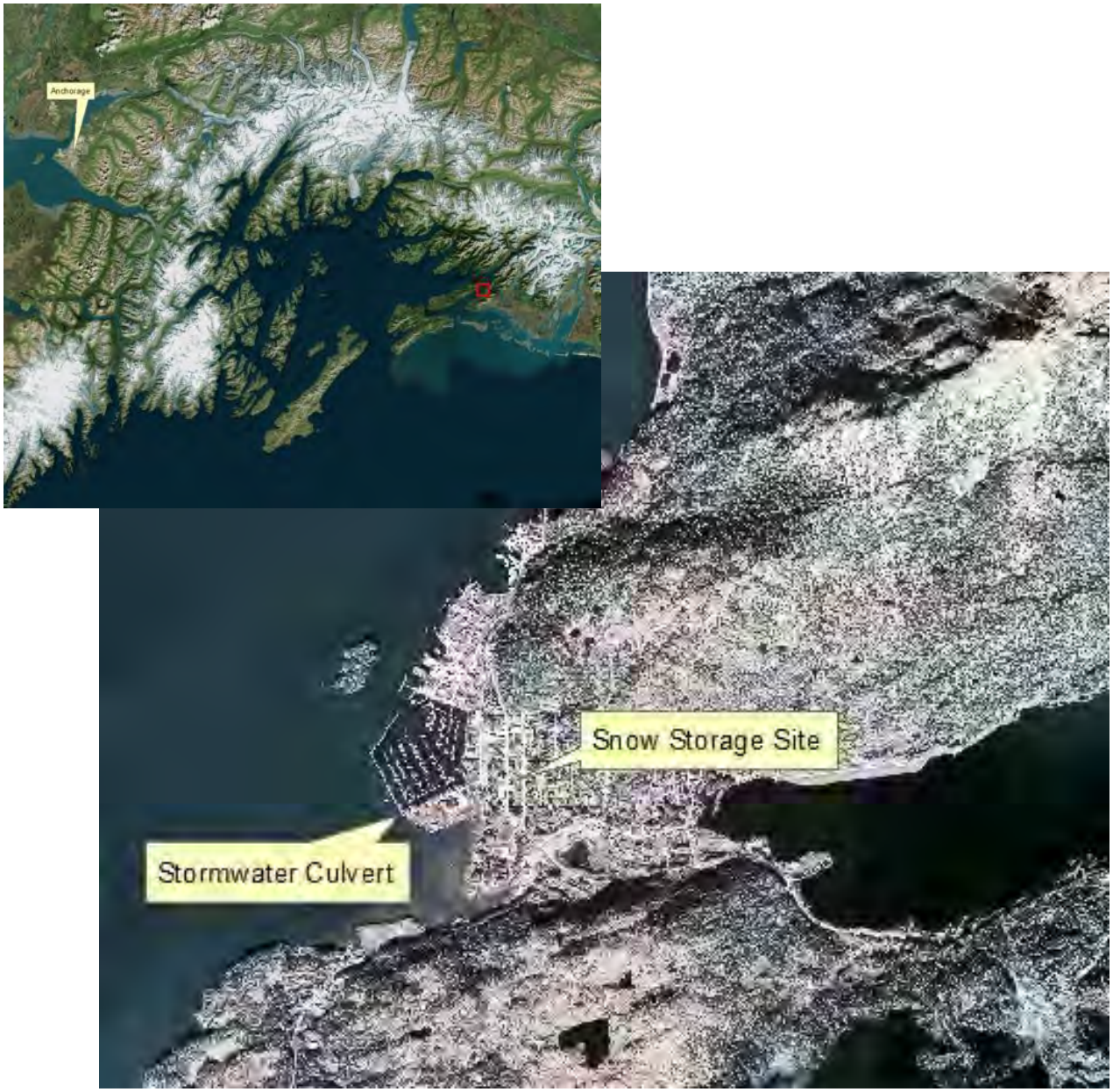
- What products and equipment are used for snow management and handling?
- What pollutants are of concern for local waterways (based on adjacent land use type)?
- Who in the community makes decisions about snow storage?
- Where is snow stored?

Melting snow is one form of stormwater pollution, and targeted BMPs can help treat that form of runoff to reduce pollutants being washed into aquatic and marine habitat. The next challenge for Cordova and other small communities is treating the rainwater runoff that occurs throughout the year, effectively flushing leaked vehicle fluids, heavy metals from brake pads, and sediment from construction sites into receiving waters. Dr. Charles Peterson and colleagues, in assessing 14 years of research on chronic exposure to the *Exxon Valdez's* lingering oil, notes that this research shows that developed communities need to incorporate treatment measures for this pollution into their operations to protect water quality : "Our synthesis implies necessary modifications of environmental standards for water quality, stormwater control, chronic low-level oil releases, and other human activities."

As with snow meltwater, mechanical and biological filtration are the two primary methods of treating stormwater. The State of Oregon has found that "Economical methods for removing turbidity and suspended solids from storm water run-off are limited. Bioswales and constructed wetlands may be the most economical approach, when both initial and maintenance costs are considered, for removing turbidity and suspended solids along with other pollutants" (Jurries, 2003).

II. Introduction

With this project, the Copper River Watershed Project worked to demonstrate that application of Best Management Practices (BMPs) to managing snow in a developed community improves the water quality of snowmelt discharges that flow directly into Orca Inlet, the habitat range of the majority of PWS juvenile herring (S. Pegau, personal communication, June 2013). In eastern Prince William Sound, where two-thirds of the juvenile herring population were observed in June, 2013 (S. Pegau, personal communication), stormwater run-off from rain and snowmelt is discharged directly into the Cordova harbor and into Orca Inlet.



Prince William Sound, Southcentral Alaska, and location of Cordova on eastern edge of Prince William Sound.

Non-point source stormwater run-off is among the leading contaminants degrading water quality in the U.S. today (National Water Quality Inventory, 2004, EPA). Unlike sewer system flows, most often there is no "end of pipe" treatment for stormwater run-off. Not only is stormwater run-off a widespread problem, but synthesized research on the long-term impacts of the *Exxon Valdez* oil spill found that chronic persistence of oil is a "major pathway" for sub-lethal population impacts in the marine environment:

> Laboratory experiments show that these multi-ringed polycyclic aromatic hydrocarbons (PAHs) from partially weathered oil at concentrations as low as 1 ppb [part per billion] are toxic to pink salmon eggs exposed for the months of development and to herring eggs exposed for 16 days (Marty et al., 1997 and Heintz et al., 2001 in Peterson et al., 2003).

Melting snow becomes surface run-off, and carries entrained pollutants in the flow: "Snow removed from roads and parking lots has been shown to contain various pollutants, including road salt, sand, litter, animal waste, and automotive pollutants such as metals and oil" (Alaska Department of Environmental Conservation guidance on "Snow Disposal Area Siting", ADEC web site). Harmful contaminants in plowed snow are well documented in the national literature (Novotny and Olem, 1994; Meyer, Lei and Wania, 2010).

CRWP worked with municipal and state agency partners and an engineering firm to examine snow management practices within Cordova, identify opportunities for treatment of stormwater, implement BMPs, and develop a guidance document for sharing snow management guidelines with other coastal Alaska municipalities.

As noted in a 2009 *Cordova Stormwater Design Study Report*, "Disposing of or storing snow on water bodies does not comply with Alaska regulations. . . This action is only allowed with an emergency permit, and storage must be on a marine water body. Snow storage on fresh waterbodies is not permitted due to the water bodies' low tolerance to chloride, potential for sedimentation, and potential for stagnation or meromixis where there is permanent stratification in the waterbody (ADOT 2003)" (Jacobs Engineering, 2009).

Jacobs engineering further explains: "Sediment may not be just sand; it may be laden with contaminants from the street, parking lots, and other sources condensed into a small area at the snow pile. . . . Soluble contaminants tend to exit the snow pack early in the melt season, creating a time-varied concentration release of contaminants while the less soluble contaminants remain until the later phases. These contaminants adsorb to the sediments, adhere to the surface of the snow pack, and are often flushed all at once during a rain event later in the melt season (ADOT 2003)."

III. Objectives

The CRWP's hypothesis holds that the water quality of snow melt-water and stormwater discharges can be improved by applying Best Management Practices to snow handling and storage in Cordova. We had four objectives for improving water quality from melt-water run-off discharged from snow piles formed from clearing City of Cordova streets:

- Analyze City of Cordova snow management practices and make recommendations to help reduce snow melt-water pollution being discharged into aquatic and marine environments. By analyzing costs, efficiency and environmental impacts, a plan was developed that includes: (1.) a long-term plan for snow management; (2.) short- and long-term improvements to snow management practices; and (3.) identification of potential snow storage and treatment sites for reducing snow melt-water run-off.
- Implement Best Management Practice (BMP) filtration structures at up to three sites around Cordova for filtering snow melt-water. Referred to as "structural BMPs," these constructed treatment areas "are designed to control the rate and volume of stormwater run-off, release of pollutants to receiving waters, and/or remove pollutants once they are incorporated into the stormwater run-off" (Shannon and Wilson, 2006, BMP Effectiveness Report 18-9001-15 Fairbanks, AK).
- Monitor stormwater run-off water quality before and after implementation of BMPs. Since the goal is to reduce downstream pollutant loads and concentrations of pollutants, we planned to follow a water quality testing regime that determines whether the effluent (or downstream water quality) is cleaner than the influent (or upstream water quality). Negligible snowfall levels during the grant period prevented us from sampling snow meltwater.
- Synthesize results on the effectiveness of BMPs (maintenance required, results of water quality monitoring) and the cost-effectiveness of each approach applied with regard to water quality improvements in a "BMP Guidance Report" that will be distributed to other small, coastal municipalities.

IV. Methods

Throughout this project, the Copper River Watershed Project worked with a group of staff from the City of Cordova, the Alaska Department of Transportation & Public Facilities(ADOT/PF), and the Cordova Community Medical Center (CCMC, located adjacent to Odiak Pond). Our planning group included:

City of Cordova
- Public Works Director
- Public Works Supervisor
- City Planner
- Parks & Recreation Director
- City Manager
- Loader Operator

ADOT/PF
- Maintenance Station Foreman
- Maintenance Supervisor

CCMC
- CCMC Administrator
- CCMC Maintenance Director

This group was involved from the earliest stage of the project, including reviewing snow management analysis proposals from engineering firms that were received following a competitive solicitation of proposals. The group selected DOWL Engineering from among the respondents.

Active support of municipal and state agency employees in this process was a critical part of the engineers' being able to conduct an analysis of municipal and state snow management operations. The engineers were allowed access to staff for interviews, to their vehicle shops for reviewing equipment, to their snow management records and maps for analyzing timing of moving snow and the routes used. Staff also participated in many meetings, teleconferences, and site visits to share their first-hand knowledge of local practices and site-specific logistics of snow handling. Drafts of the Cordova Snow Management Practices Analysis Report and of the Coastal Alaska Snow Management Guidance Report were circulated to all members of the planning team. Several staff members sent back detailed comments that helped increase the accuracy of statements made, and also posed questions for discussion in the guidance document that helped ensure it would be more widely understood for a municipal staff audience. City staff also worked with the CRWP to modify an existing Memorandum of Understanding (MOU) to include the snow storage site created under this grant. The MOU outlines the stormwater controls covered under the agreement and maintenance and monitoring responsibilities that are shared between the City and the CRWP.

DOWL Engineering visited Cordova in March, 2014 to interview City of Cordova Public Works crew members and Alaska Department of Transportation & Public Facilities road crew members to document their current snow management practices. A teleconference call was held in December, 2014 to meet with the Cordova planning group facilitated by the CRWP and review the draft Analysis Report. As stated in the Cordova Snow Management Practices Analysis Report, steps taken for this analysis were:

- Summarize current snow management practices on Cordova roads and streets by mapping snow piling locations and snow source areas;
- Document equipment and methods used and how practices may vary with type of snow loads throughout the season and during high or low snow seasons;
- Evaluate the current snow management practices on Cordova streets and roads for ways to reduce polluted runoff; and
- Make recommendations for procedural and structural best management practices to reduce pollution from snow melt runoff discharged into receiving waters and draining to Orca Inlet.

The Analysis Report included a map of all Cordova snow storage areas, including those that have a buffer of less than 75' from receiving waters (see Figure 1). From among the group of those with inadequate buffers, two sites were chosen for design of treatment structures because of their proximity to receiving waters and the volume of snow stored (historically) at those sites. DOWL Engineers made a second site visit in January, 2015 to visit those two sites with the CRWP and the City staff members of the planning team. Design drawings for Best Management Practice improvements at those two sites are attached to this report (see Appendices B and C). The CRWP issued a solicitation for bids for improvements at the Odiak Pond snow storage site, and that work was completed by the selected contractor in July, 2015 (see Appendix A., *Cordova Times* article, January 29, 2016).

The CRWP budgeted grant funds to conduct water quality sampling of snow meltwater runoff before and after implementation of the Best Management Practice improvements, but snowfall in the three winters over which this grant period fell was so low that meaningful sampling could not be conducted. In 2013 the maximum snow depth was 27", in 2014 it was 39" in January of that year and in 2015, the maximum depth was 37" on December 28 (SNOPack TELemetry site established by NRCS National Water and Climate Center, http://www.wcc.nrcs.usda.gov/nwcc/view).

Dissemination of useful findings to other small communities with similar snowfall levels and water quality concerns and continuing public education within the Cordova community was the final phase of this project. CRWP staff prepared slide show presentations and participated in two professional conferences to make these presentations in October, 2015. The two conferences were held by the Alaska Association of Port and Harbor Administrators and the Alaska Rural Water Association. DOWL Engineers also prepared a Coastal Alaska Snow Management Guidance Report that will be distributed to those two professional associations for distribution to their members. The Guidance Report was reviewed for usefulness and clarity by the City of Cordova Public

Works staff. Compiled from knowledge gained while assessing Cordova's snow management practices and from experience working in other communities, the Guidance Report covers the regulatory background, pollutants common to urban snowmelt, land use planning, operational and maintenance challenges, best management practices (BMPs), and capital costs (DOWL, 2016).

To keep community leaders informed of our efforts directed at treating snow meltwater pollution, CRWP staff made several presentations at municipal government meetings. We gave slide shows at two City Council meetings, several Planning & Zoning Commission meetings, and two Parks & Recreation Commission meetings.

V. Results

Snowmelt Sampling Plan (DOWL, 2014). A snowmelt sampling plan was designed to characterize snowmelt runoff water quality from snow storage sites in Cordova in order to guide decisions regarding modifying snow management practices to improve the quality of urban runoff reaching receiving waterbodies. The plan was designed to acquire snowmelt water quality data and site specific features of snow storage sites under baseline conditions, and then sample snow meltwater runoff again after site modifications had been implemented at snow storage sites. The plan identified sampling parameters, and included a sampling schedule, data sheets, and sample collection and field analysis methods.

Cordova Snow Management Practices Analysis Report (DOWL, 2015). The engineers analyzed the City of Cordova's and the Alaska Department of Transportation & Public Facilities' snow management practices within the City of Cordova and made recommendations for each partner (City of Cordova, ADOT/PF, CRWP) based on each partner's "realm of influence." Recommendations were evaluated for their potential to improve water quality and/or operational efficiency (effectiveness) against the level of effort/investment required to implement (cost). For the CRWP, the engineers suggested two criteria for working with the City to identify sites at which to improve snow storage site sediment capture: (1.) close proximity to receiving waters or storm drain inlets; and (2.) regularly receive a large volume of snow. Both the City and ADOT/PF should keep records on equipment and use of traction aids, and should meet annually to review their respective experiences. The CRWP and the City could work on introducing site development requirements for new construction that would minimize snow meltwater run-off.

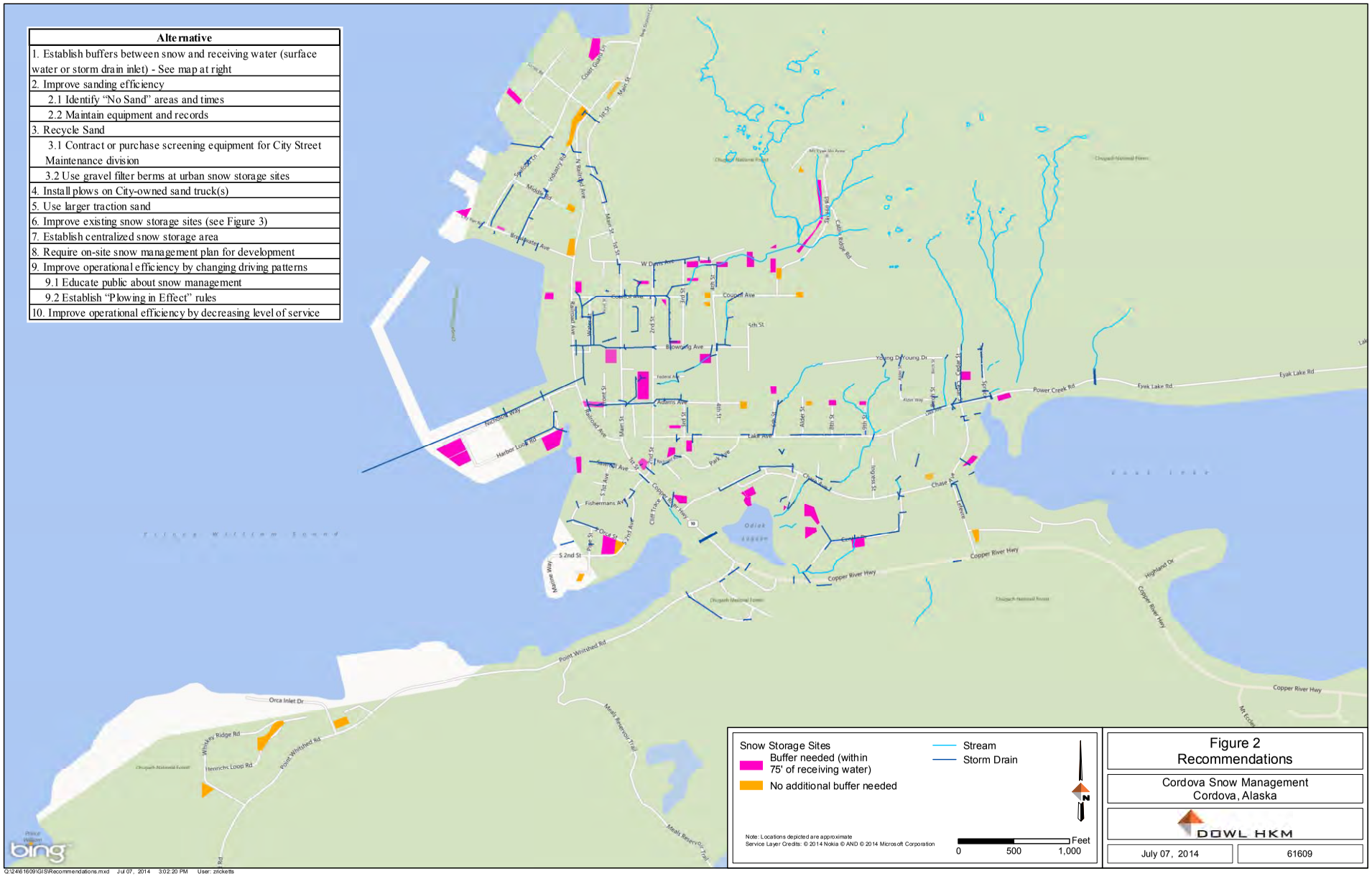


Figure 1: Map of all City of Cordova and Alaska Department of Transportation & Public Facilities snow storage sites. Locations shown in pink have inadequate buffers to receiving waters, locations shown in orange have sufficient buffers to receiving waters (DOWL, 2015).

Coastal Alaska Snow Management Guidance Report (DOWL, 2016). To assess what improvements might be achieved in a community's snow management system, and what changes might be most effective, DOWL recommends collecting information to answer the following questions: (1.) what products and equipment are currently used? (2.) what pollutants are of concern for local waterways? (3.) who makes snow management decisions? and (4.) where is snow stored? This evaluation of current practices, disposal locations and operations, and water quality impacts can help communities make informed decisions about improving practices in a cost effective manner.

Completed design drawings for two snow management sites (DOWL): attached are two sets of signed engineered drawings for structural Best Management Practice (BMP) improvements at Cordova snow storage sites (see Appendices B and C). The CRWP completed the improvements at the site draining to Odiak Pond in July, 2015. Having "shovel ready" drawings for the second site in hand greatly helped the CRWP leverage its application for construction funding from the National Fish & Wildlife Foundation, and those funds have been awarded to the CRWP from the National Fish & Widlife Foundation (2/18/16) for constructing the improvements at the 2nd & Adams Streets site. This work will likely be conducted in fall, 2016.

Cordova Times article, January 29, 2015 (CRWP): see Appendix A.

Snow Management slide show presentation (CRWP): on the recommendation of Alaska Department of Environmental Conservation staff, CRWP staff made presentations about this work at two professional conferences in October, 2015. By attending the Alaska Association of Port Administrators and Harbor Masters (10/14/15) and the Alaska Rural Water Conference (10/26/15), we were able to connect with dozens of representatives from small, coastal Alaska communities with information about what actions they can take to minimize snow meltwater pollution and why it's important for water quality.

Odiak Stormwater Memorandum of Understanding (MOU): the CRWP had developed a Memorandum of Understanding with the City of Cordova in 2014 for sharing management of a stormwater biofilter that was constructed on City property. Since the snow storage V-swale is located near the biofilter, we modified the MOU to include that site also. This agreement spells out the maintenance activities for which each party is responsible.

Snow pile on shore of Odiak Pond, coho salmon habitat.
May 2012

Former snow storage site upslope of Odiak Pond.
January 2015

Site grading to form V-swale snow storage site. Pavilion was moved to the right. Site design originally called for wider swale, but we opted to retain vegetation on the left side for greater filtration.
July 2015

Snow storage V-swale in use. Note trickle path of snow meltwater draining to sediment trap in lower left foreground.
January 2016

Re-constructed foot and vehicle access path, rip rap drainage ditch to prevent erosion of gravel and fine sediment, and sediment trap basin.
July 2015.

Sheen on water surface in Odiak Pond snow storage sediment trap from parking lot runoff.
February 2016

VI. Discussion

Although we were unable to sample melting snow runoff in the "before" and "after" sequence for which we had planned, we were able to implement site improvements at one snow storage site that addressed drainage and erosion problems at that site. In addition to snow meltwater pollution that had been draining into Odiak Pond, parking lot sheet flow run-off was also draining down a path at the site straight into the pond. BMP design for the snow storage V-swale included creating a sediment trap into which the melting snow drains. The engineers included a rip rap lined channel through which the water flowing from the sediment trap exits. The rip rap is more stable than the original gravel surface of the path, and will prevent erosion of fine sediment into Odiak Pond.

Solutions for snow storage are driven by several considerations, such as:

- Snow storage site land use (some snow storage sites are next to parks, some are in industrial areas) and adjacent land uses. These land use types will determine what types of pollutants may be present.
- proximity to watercourses, especially documented fish habitat;
- volume of snow stored at a particular site;
- slope of snow storage site or adjacent lands;
- accessibility of site to snow handling equipment; and
- cost of equipment, land, and BMP site improvements.

Given these considerations, the first step of a snow storage planning process should be identification by municipalities and state agencies of pollutants of concern. With a list of pollutants to be targeted, a city or an agency can then pick BMPs for those pollutants. For example, if pet waste is a particular stormwater runoff concern, a combination of a bio-filtration BMP, such as a vegetated buffer along a stream bank where people walk their dogs, and a public education BMP would be more effective than one of those BMPs alone.

Facilitation and public education were critical elements of this project. Municipalities or agencies considering implementing BMPs for snow storage should consider forming a planning team composed of community representatives for municipal or agency operations analysis, land use review, and public education. Because stormwater and snow meltwater runoff as pollutant sources are still poorly understood, the CRWP will continue its public education efforts by working with City staff (Planning Department and Public Works Department), and by targeting population segments (pet owners, homeowners, and contractors) to promote protection of waterbodies by vegetation buffers, vehicle and fuel tank maintenance, and proper disposal of pet waste.

VII. Conclusions

Protecting aquatic and marine habitat from snow meltwater pollution requires an integrated planning effort on the part of municipalities, resource managers and community partners. Coastal communities are often situated alongside river systems that connect hydrologically with the ocean, and while the most convenient locations to place snow are often ravines, wetlands and the ocean, these are also the must susceptible to the deleterious impacts of snow disposal. A basic understanding of water quality regulations, pollutants of concern, tools used in snow management, and factors affecting snowmelt is useful prior fur undertaking assessments of snow management and snow melt (DOWL, 2015).

Melting snow is one form of stormwater pollution, and targeted BMPs can help treat that form of runoff to reduce pollutants being washed into aquatic and marine habitat. The next challenge for Cordova and other small communities is treating the rainwater runoff that occurs throughout the year, effectively flushing leaked vehicle fluids, heavy metals from brake pads, and sediment from construction sites into receiving waters. Dr. Charles Peterson and colleagues, in assessing 14 years of research on chronic exposure to the *Exxon Valdez's* lingering oil, notes that this research shows that developed communities need to incorporate treatment measures for this pollution into their operations to protect water quality : "Our synthesis implies necessary modifications of environmental standards for water quality, stormwater control, chronic low-level oil releases, and other human activities."

The broader legacy of the *Exxon Valdez* oil spill, Dr. Charles Peterson observed, is "Recognition that chronic exposures of fish eggs to oil concentrations as low as a few parts per billion lead indirectly to higher mortality [showing] the critical need to better control stormwater run-off of petroleum hydrocarbons and other toxins. In a developed country like the United States, an amount of petroleum equal to the *Exxon Valdez* oil spill is spilled annually for every 50 million people" (Peterson, 2003).

As with snow meltwater, mechanical and biological filtration are the two primary methods of treating stormwater. The State of Oregon has found that "Economical methods for removing turbidity and suspended solids from storm water run-off are limited. Bioswales and constructed wetlands may be the most economical approach, when both initial and maintenance costs are considered, for removing turbidity and suspended solids along with other pollutants" (Oregon DEQ, 2003).

The Copper River Watershed Project will continue to look for sites in the Cordova community that present opportunities for filtering stormwater runoff before those flows are discharged to sensitive receiving waters such as aquatic salmon habitat and nearshore marine herring habitat.

VIII. Acknowledgements

We would like to thank the *Exxon Valdez* Oil Spill Trustee Council for funding this work and advancing the application of research on oil toxicity that was conducted in the aftermath of the *Exxon Valdez* oil spill. We want to acknowledge the strong support from our project partners, the City of Cordova and the Alaska Department of Transportation & Public Facilities. The City of Cordova has been a very responsive supporter by allowing the CRWP to do work on City property and by assuming the maintenance responsibilities for the stormwater controls we created with grant funds. Rich Rogers, Cordova Public Works Director, and Bill Howard, Cordova Public Works Supervisor, participated in site visits, teleconferences and were diligent about reviewing reports to ensure their accuracy and usefulness to other municipalities. We also would like to thank Erika Amman, Laurel Jennings and other staff from the NOAA Restoration Center for their participation and guidance in ensuring that this project was as relevant as possible for replication in other communities.

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XI. Appendices

Appendix A.
Cordova Times article, 1/29/16 on Odiak Pond Snow Storage Site Improvements

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Appendix A.
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TEST YOUR HOME

Check to be sure your home is radon free

BY THE CORDOVA TIMES STAFF

January is National Radon Action Month and the U.S. Environmental Protection Agency is encouraging everyone to test homes for radon, the second leading cause of lung cancer.

Each year some 21,000 Americans die from lung cancer caused by exposure to radon, a colorless, odorless, radioactive gas.

Radon forms naturally from the breaking down of radioactive elements such as uranium, which are found in different amounts in soil and rock worldwide. Radon gas in the soil and rock can move into the air and into underground water and surface water.

Radon exposure is preventable, says Janet McCabe, acting assistant administrator for EPA's Office of Air and Radiation. Test kits are inexpensive and readily available. Reducing exposure protects families, saves lives and avoids the health care costs of radon-caused lung cancer.

Affordable do-it-yourself radon test kits are available online, at many home improvement and hardware stores and easy to use. If your home is found to have a high radon level, a professionally installed radon reduction system, using a vent pipe and exhaust fan, will remove the radon from beneath your home and discharge it outside. These systems are affordable, especially compared to the risk of lung cancer, McCabe said.

UNEMPLOYMENT

Jobless rates flat in most of Alaska

BY THE CORDOVA TIMES STAFF

State Labor Department officials say Alaska's seasonally adjusted unemployment rate was 6.5 percent in December, essentially unchanged from November's 6.4 percent.

What this means is that approximately the same number of people were employed in seasonal work for this period as for the previous month.

The comparable national rate of unemployment was 5.0 percent.

Alaska's seasonally adjusted rate showed no clear trend in 2015, consistent with other economic indicators that suggest last year's economy was relatively flat.

The not-seasonally adjusted rate was 6.6 percent in December, up from November's 6.4 percent. December was the first month in 2015 that the unadjusted rate was higher than the same month in the previous year.

Around Alaska, jobless rates were flat or rose from November to December in 27 of 29 boroughs and census areas, which is typical for this time of year.

SNOW MELTOFF

Snow storage site on the bank of Odiak Pond in January 2015. Melting snow carried sediment and adsorbed pollutants to coho salmon habitat in the pond.

Snow stored in new V-swale, with melting snow draining to sediment trap. Sediment will be deposited in this basin before melting snow drains to Odiak Pond.

SNOW MANAGEMENT MATTERS

Or, how do plants and soil work like a coffee filter?

BY KRISTIN CARPENTER

For The Cordova Times

Our City's Public Works crew know that snow management matters, of course, because it's a public safety issue and a concern for access to City streets if snow isn't moved out of the way. But snow management also matters for water quality, and ultimately, to our local economy. The fish that we harvest and the waterfowl and fur mammals that we hunt and trap use our ponds, lakes and streams within our City for spawning and foraging.

We often think of snow as "fresh" and "pure," but snow plowed from our streets carries with it oil, grease, anti-freeze, heavy metals, trash, and debris. Melting snow drains all of that to nearby receiving waters.

In Cordova, that means that a toxic drip has been flowing from melting snow piles into Eyak Lake, Odiak Pond, and Orca Inlet. We call Eyak Lake our "Million Dollar Lake" because it generates roughly $1,000,000 annually in ex-vessel seafood sales of sockeye and coho salmon (ADF&G Annual Management Reports). Odiak Pond has coho spawning in one of the inlet streams and has served as a long-time teaching spot for school field trips. And surveys from 2013 found that two-thirds of the Prince William Sound juvenile herring biomass was located in the eastern Sound, through which the waters of Orca Inlet circulate.

To help with snow management on a municipal level, the CRWP has been working with the City of Cordova to identify filtration opportunities for treating polluted snow melt run-off. (This is where the coffee filter comes in.) Plants and soil serve as biological filters, so leaving a buffer of vegetation between a pollution source and water allows for biological and chemical processes to break down pollutants. A Biofilters Handbook published by the State of Oregon explains that some pollutants are removed from water flow by vegetation uptake, some by natural coagulation of particles from decomposing vegetation, some by just slowing the flow down enough for sediment to drop out, and some by biota consumption and ionic attraction around root structure (State of Oregon DEQ, 2003).

Last summer, with funding from the Exxon Valdez Oil Spill Trustee Council, we implemented a "best management practice" at one of the City's snow storage sites. The City had a practice of piling snow up on the bank of Odiak Pond, where the snow pile would melt and drain directly into the pond, carrying with it all the accumulated pollutants scooped up by plowing. The City agreed to move the Hollis Henrichs Park pavilion, making room for a re-graded V-swale to hold plowed snow. Sitting just above a line of alders and willows that will bank the snow pile, melting snow will now drain down to a sediment trap that will capture most of the road sand, and the hydrocarbons attached to those particles. Any snow melting directly down slope to the pond will be filtered by the vegetation left in place. The sediment trap will be scooped out seasonally by the City.

You can help with snow management by keeping snow out of fish streams, lakes and wetlands and at least 50' away from the water's edge. The best place to store snow is on a lawn or vegetated site where contaminants and debris can be gradually released and contained or collected.

Kristin Carpenter, Executive Director, Copper River Watershed Project, can be reached at kristin@copperriver.org.

MAY THE FORCE BE WITH YOU

Imperial Stormtrooper, Matt Rush, stands guard as Junior Stormtrooper, Samaya Thomas, faces Darth Vader, aka Dylan Maloney. The Cordova Public Library's Star Wars Family Fun Night was Jan. 21.

PHOTO BY DEBBIE CARLSON

The Cordova Times

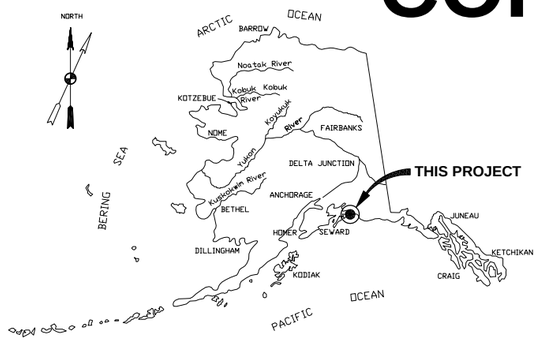
Appendix B.
Odiak Pond Snow Storage Site Improvement design drawings

COPPER RIVER WATERSHED PROJECT

Appendix B

2ND STREET & ADAMS SNOW STORAGE SITE IMPROVEMENTS, CORDOVA, ALASKA

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST COPPER RIVER MERIDIAN, ALASKA



LOCATION MAP
NTS

ABBREVIATIONS

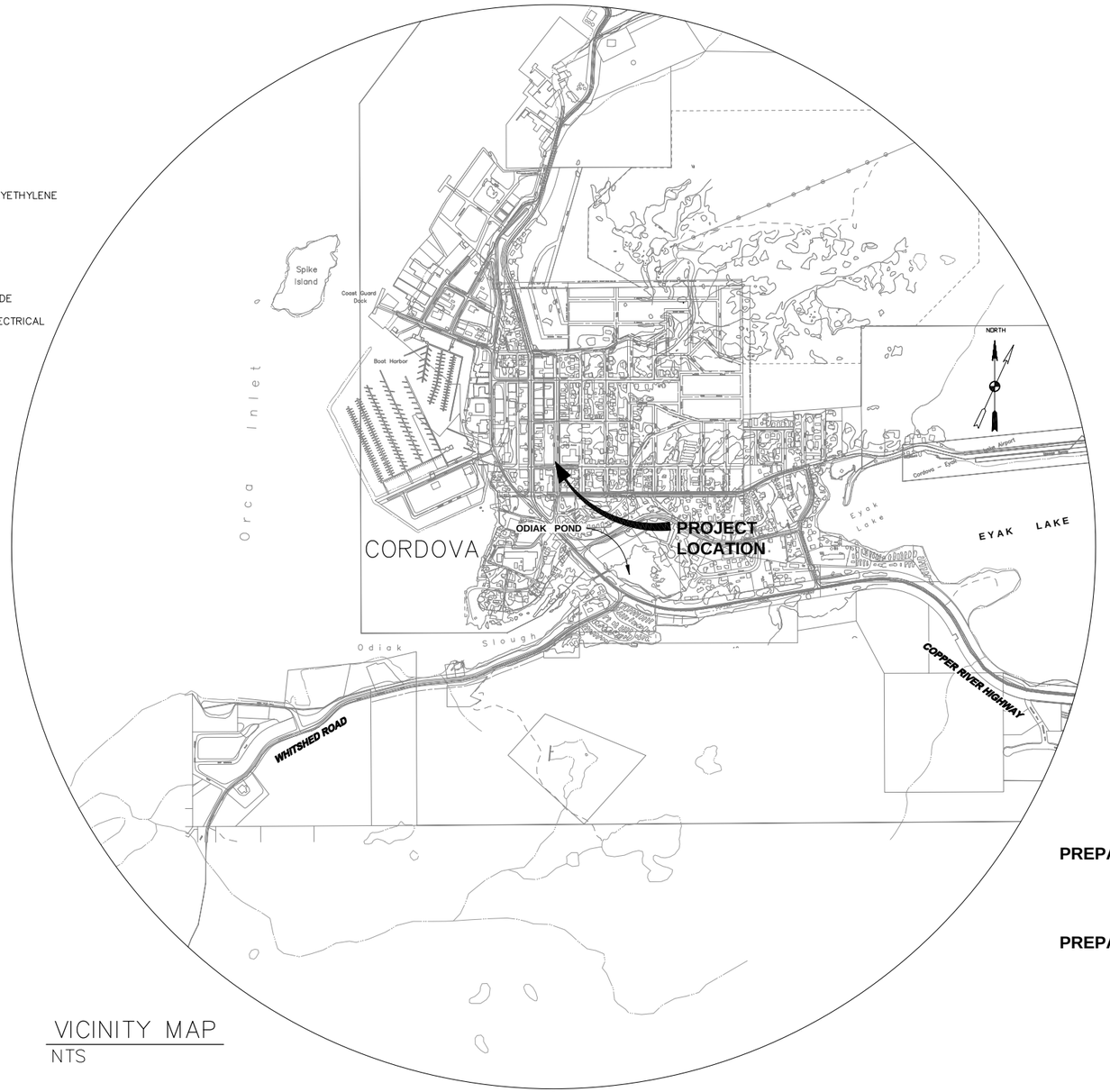
ADOT & PF	–	ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
B.O.P.	–	BEGINNING OF PROJECT
C	–	COMMUNICATION LINE
℄	–	CENTERLINE
CMP	–	CORRUGATED METAL PIPE
CRWP	–	COPPER RIVER WATERSHED PROJECT
DIA	–	DIAMETER
EG	–	EXISTING GRADE
ELEV	–	ELEVATION
E.O.P.	–	END OF PROJECT
FG	–	FINISH GRADE
GB	–	GRADE BREAK
HDPE	–	HIGH DENSITY POLYETHYLENE
HORIZ	–	HORIZONTAL
I.E.	–	INVERT ELEVATION
MAX	–	MAXIMUM
ME	–	MATCH EXISTING
MH	–	MANHOLE
MIN	–	MINIMUM
NTS	–	NOT TO SCALE
O.C.	–	ON CENTER
PVC	–	POLYVINYL CHLORIDE
STA	–	STATION
UE	–	UNDERGROUND ELECTRICAL

LEGEND

PROPOSED	EXISTING	
	⊕	SURVEY MONUMENT
	(901)	CONTROL POINTS
	⊏	SIGN
	⊸☼	LIGHT
	—E—	BURIED ELECTRIC
	— GCI —	UNDERGROUND GCI CABLE
	—U TEL—	UNDERGROUND TELEPHONE
	◎	STORM DRAIN MANHOLE
	=SD=	STORM DRAIN LINE
	—W—	WATER LINE
		PIPE
		ROAD EDGE
		GRAVEL EGDE
1000	— 1000 —	CONTOURS MAJOR(5)
		CONTOURS MINOR(1)
	—R/W—	RIGHT OF WAY
		PROPERTY LINE
		RIP RAP
		POROUS BACKFILL MATERIAL
		TOPSOIL

SHEET INDEX

C1 COVER SHEET
C2 PLAN VIEW
C3 V-SWALE PROFILE VIEW AND DETAILS
C4 BASIN DETAILS
C5 LANDSCAPE PLAN



VICINITY MAP
NTS

SPECIFICATIONS:

1. ALL CONSTRUCTION SHALL BE COMPLETED IN ACCORDANCE WITH THE CURRENT ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES (ADOT&PF) STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION 2015 EDITION.

THE FOLLOWING ADOT&PF STANDARD DRAWINGS APPLY TO THIS PROJECT:
D-42.11

GENERAL NOTES:

1. SURVEY INFORMATION WAS PROVIDED BY ST DENNY SURVEYING, INC. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF ALL SITE FEATURES. IF THE CONTRACTOR SHOULD ENCOUNTER CONDITIONS OTHER THAN THOSE SHOWN ON ALL THE PLANS, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATIVE.
2. PLANS MAY NOT SHOW ALL EXISTING UTILITIES ON SITE. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. FOR UTILITY LOCATES, CALL (907)424-8344 OR FAX REQUEST TO (907)424-6120.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING UTILITIES AND STRUCTURES AND SHALL EXERCISE CAUTION DURING CONSTRUCTION.
4. COORDINATE CONSTRUCTION STAGING AND MOBILIZATION AREAS AND ACTIVITIES, INCLUDING DAILY WORK SCHEDULES, WITH OWNER'S REPRESENTATIVE.
5. DO NOT BLOCK TRAFFIC ON SURROUNDING STREETS.
6. ELEVATIONS ARE TO PIPE INVERT AND CHANNEL UNLESS OTHERWISE NOTED.
7. VERIFY INVERTS OF ALL PROPOSED STRUCTURES PRIOR TO CONSTRUCTION. REPORT ANY DISCREPANCIES FROM PLANS IMMEDIATELY TO OWNER'S REPRESENTATIVE.
8. EXCAVATION AND BACKFILL:
   A. REMOVE ALL ORGANIC OR OVER SATURATED SOFT MATERIAL, WHICH CANNOT BE COMPACTED. DO NOT PLACE WASTE MATERIAL ONSITE.
   B. BACKFILL SHALL BE PLACED AND COMPACTED WITH CARE AND SHALL BE BROUGHT UP EVENLY AND SIMULTANEOUSLY ON BOTH SIDES OF PIPE.
9. PIPE INSTALLATION: PIPE JOINTS SHOULD NOT LEAK.
10. CONTRACTOR SHALL SURVEY EXISTING EDGE OF PAVEMENT ALONG ALLEY AND ADAMS AVENUE. PROPOSED GRADES RESULT IN DRAINAGE ONTO SITE.
11. ALL VEGETATION IN THE AREAS NOT AFFECTED BY WORK SHALL BE PRESERVED AND PROTECTED BY THE CONTRACTOR. RESEED ALL NON-DRIVABLE DISTURBED AREAS.

PREPARED BY:
DOWL
4041 B STREET ANCHORAGE, ALASKA 99503
907-562-2000 www.dowl.com

PREPARED FOR:
COPPER RIVER WATERSHED PROJECT

MONUMENT AT INTERSECTION OF ADAMS AVE AND 1ST STREET
PROJECT CONTROL:
N: 2390767.31
E: 543802.65

MONUMENT AT INTERSECTION OF BROWNING AVE AND 1ST STREET
PROJECT CONTROL:
N: 2391272.27
E: 543802.86

N: 2390797.25
E: 543951.66

N: 2391047.25
E: 543951.77

EXISTING INLET BOX
RIM=79.9

EXISTING 12" CMP

EXISTING MANHOLE
RIM=80.3

EXISTING MANHOLE
RIM=80.2

ALLEY

EDGE OF PAVEMENT

GCI VAULT

REMOVE TEMPORARY SIGN, DELIVER TO CITY SHOP

SIGN

1.5% AVG.

SEDIMENT BASIN
SEE C-4

CLASS I RIPRAP

REMOVABLE BOLLARDS, SEE DETAIL 2/C4

BEGINNING OF PROJECT
AT EDGE OF PAVEMENT
STA: 0+16.49
N: 2390783.71
E: 543990.6972

V-SWALE
CENTERLINE

1%

1+00

2+00

18" CMP

FLEXIBLE DELINEATOR POSTS
5' APART O.C., SEE DETAIL 1/C4

4" PERFORATED
DRAIN PIPE

STA: 2+12.06
N: 2390979.12
E: 543982.73

3+00

E.O.P AT PROPERTY LINE
STA: 2+84.81
N: 2391047.23
E: 543993.78

TYPE "C" INLET BOX,
SEE DOT&PF STANDARD
DRAWING D-42.11

STA: 2+26.63
N: 2390989.06
E: 543993.39

2%

EDGE OF PAVEMENT

ADAMS AVENUE

N: 2390797.21
E: 544051.66

SIGN

N: 2391047.21
E: 544051.76

SIGN

EDGE OF PAVEMENT

TELEPHONE VAULT

ADD ALTERNATE 1:
EXCAVATE TO GRADES
SHOWN PRIOR TO SLOPE
STABILIZATION.

SECOND STREET

EXISTING STORM DRAIN,
LOCATION APPROXIMATE,
ELEVATION UNKNOWN

CONTRACTOR TO DETERMINE
DEPTH OF INVERT AND REPORT TO
OWNERS REPRESENTATIVE PRIOR
TO BEGINNING SITE WORK

10 0 10
SCALE IN FEET

REVISIONS

REV	DATE	DESCRIPTION	BY

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WWW.DOWL.COM

2ND ST & ADAMS AVE SNOW STORAGE SITE IMPROVEMENTS
CORDOVA, ALASKA

PLAN VIEW

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT 61609-02
DATE 02/19/2016

SHEET
C-2

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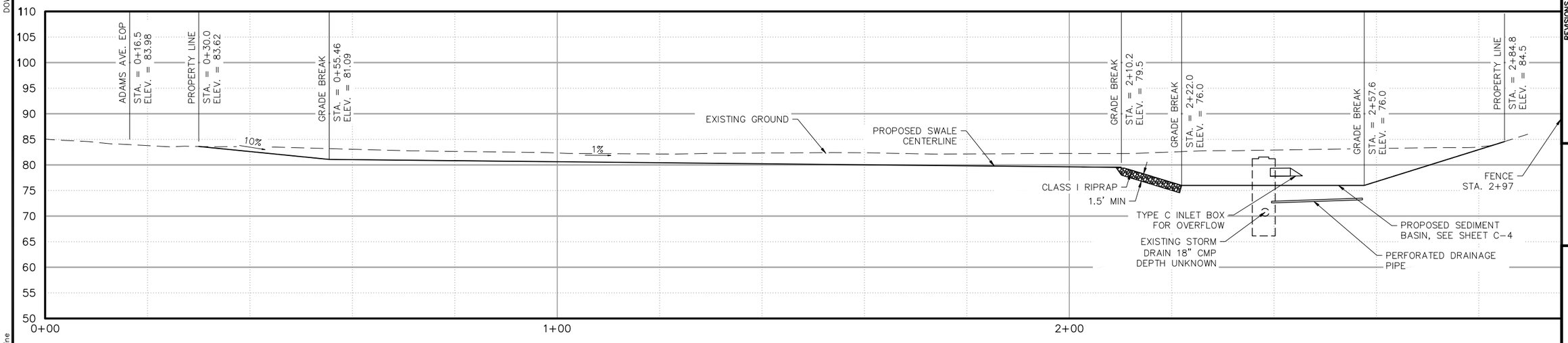
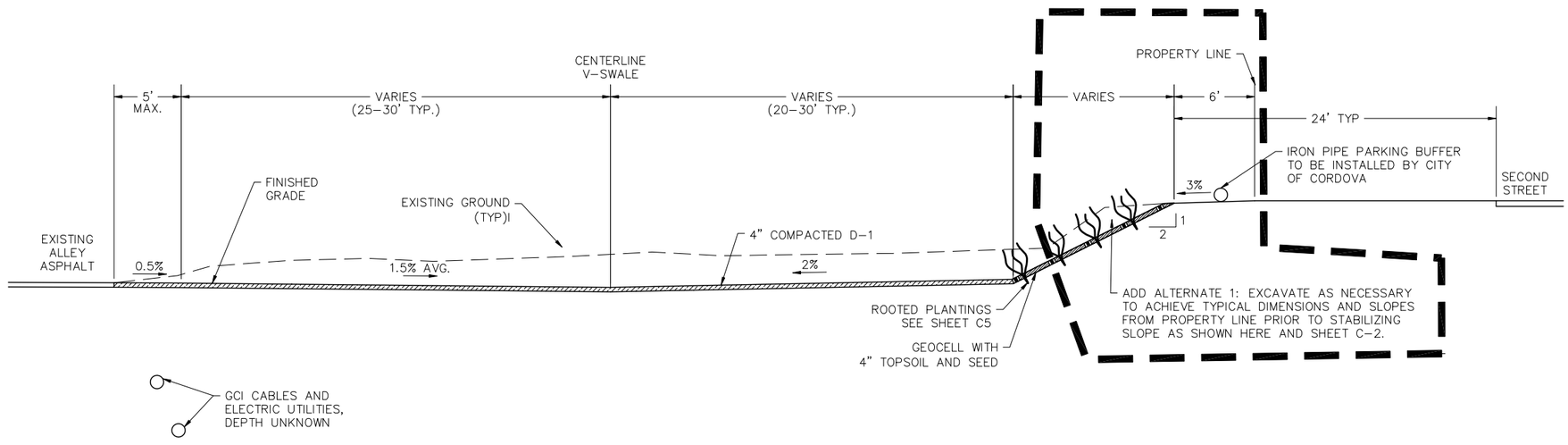
Appendix B



1/C3 V-SWALE PROFILE
SCALE: 1"=10'



2/C3 V-SWALE SECTION - TYPICAL
NTS
STA. 0+55 TO 2+20

REVISIONS

REV	DATE	DESCRIPTION	BY

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2ND ST & ADAMS AVE SNOW STORAGE SITE IMPROVEMENTS
CORDOVA, ALASKA

V-SWALE PROFILE VIEW AND DETAILS

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT 61609-02
DATE 02/19/2016

SHEET
C-3

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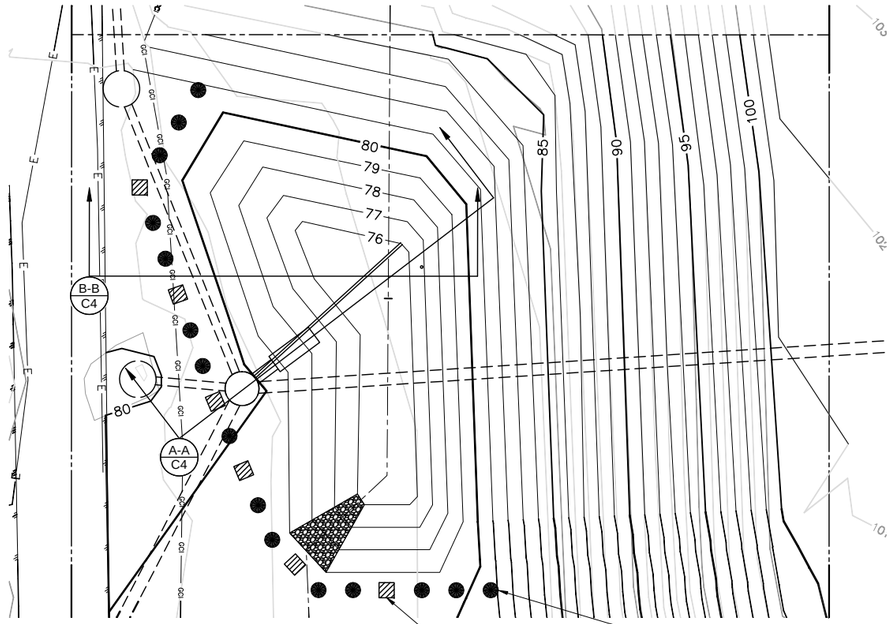
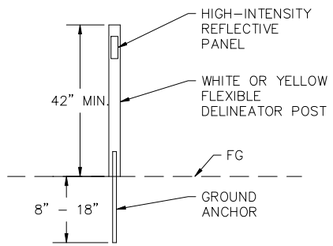


SEDIMENT BASIN DETAIL - PLAN VIEW

SCALE: 1"=5'

REMOVABLE BOLLARDS, SEE DETAIL 2/C4

FLEXIBLE DELINEATOR POSTS 5' APART O.C. OR CLOSER, SEE DETAIL 1/C4



1/C4 FLEXIBLE DELINEATOR POST

NTS

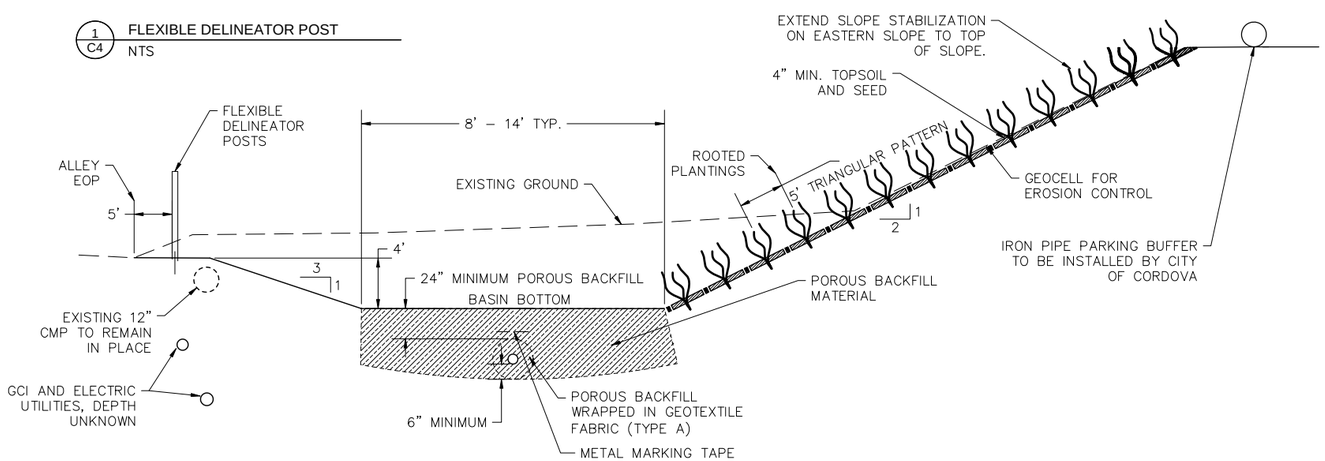
NOTES:

1. PERFORATED DRAIN PIPE TO HAVE A MINIMUM OF 24 HOLES PER LINEAR FOOT 3/8" DIA. OR GREATER. PIPE TO BE SCHEDULE 40 PVC OR GREATER.

2. OVERLAP GEOTEXTILE FABRIC 6" MIN.

3. FLEXIBLE DELINEATORS MAY BE TUBULAR (2" MIN. DIA.) OR CURVED PANEL STYLE (3" MIN. WIDTH). INSTALL ACCORDING TO MANUFACTURER'S DIRECTIONS WITH REFLECTIVE PANEL FACING ALLEY/PARKING LOT.

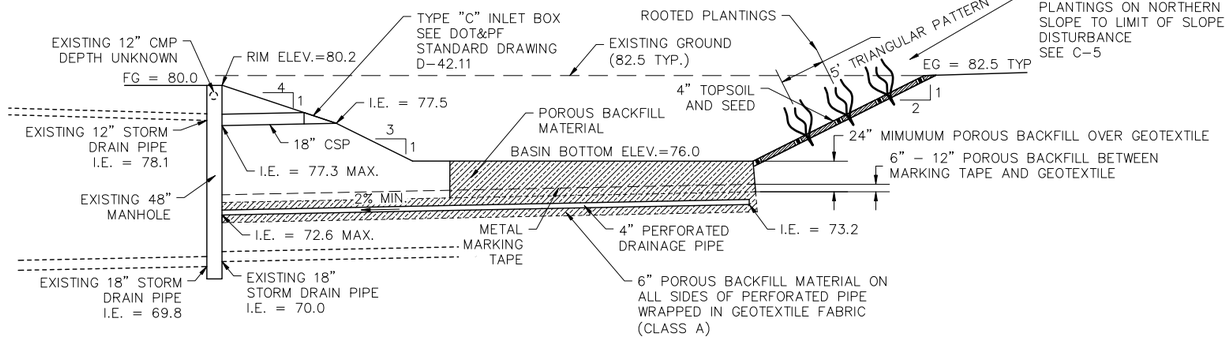
4. 6-INCH MINUS BONE ROCK (LESS THAN 10% PASSING 1-INCH SIEVE. LESS THAN 5% PASSING NO. 200 SIEVE) MAY BE USED IN LIEU OF POROUS BACKFILL MATERIAL.



B-B/C4 BASIN SECTION

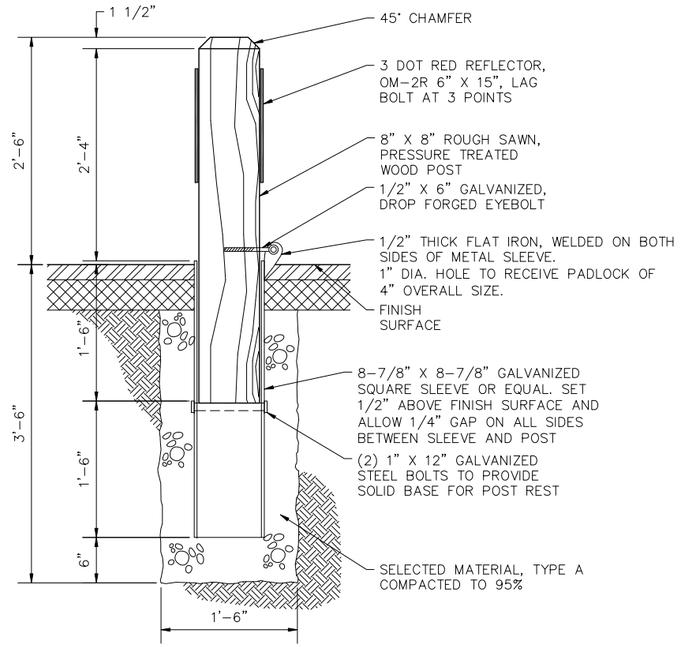
NTS

Appendix B



A-A/C4 BASIN OUTLET DETAIL

NTS



2/C4 REMOVABLE WOOD BOLLARD

NTS

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2ND ST & ADAMS AVE SNOW STORAGE SITE IMPROVEMENTS
CORDOVA, ALASKA

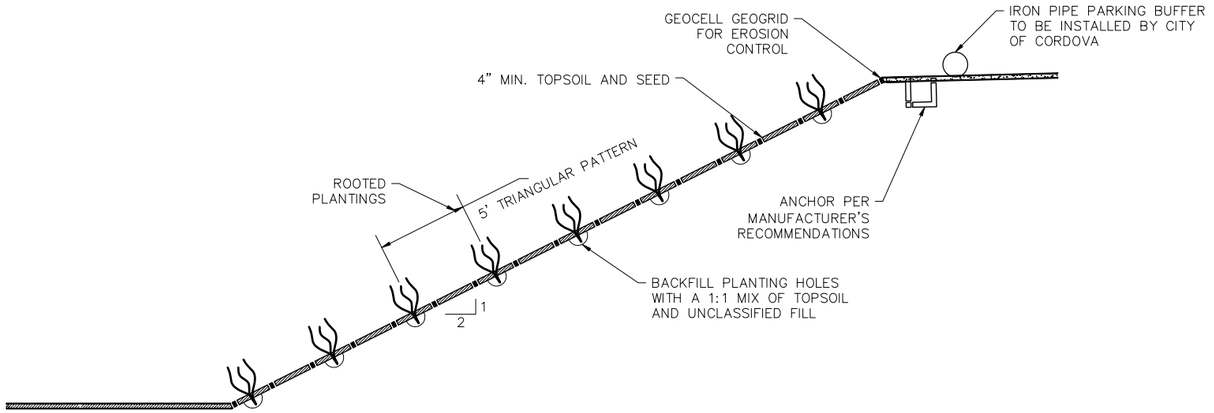
BASIN DETAILS

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

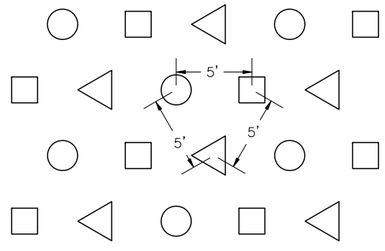
PROJECT 61609-02
DATE 02/19/2016

SHEET
C-4

Appendix B



1/C5 GEOCELL SLOPE STABILIZATION
NTS



2/C5 PLANTING LAYOUT
NTS

NOTES:

1. ROOTED PLANTINGS SHALL BE PLACED AFTER THE INSTALLATION OF GEOCELL. PLANTING HOLES MAY BE PREPARED PRIOR TO GEOCELL INSTALLATION.
2. PLANTINGS SHALL BE PLACED IN A TRIANGULAR PATTERN WITH AN AVERAGE SPACING OF 5'. MINOR ADJUSTMENTS IN SPACING WILL BE TOLERATED TO ALIGN PLANTS WITH GEOCELL HOLES. DO NOT CUT AND SPLICE GEOCELL.
3. ROOTED PLANTINGS SHALL CONSIST OF A VARIETY OF PLANTINGS AND HEIGHTS. EVENLY DISTRIBUTE SPECIES AND SIZES ALONG SLOPE.

   SPECIES MIX
   33.3% ROSE; ROSA GLAUCA, ROSA RUBRIFOLIA OR ROSA RUGOSA
   33.3% SPIRAEA JAPONICA 'GOLDFLAME', 'FROEBELI' OR 'GOLDMOUND'
   33.3% AMERICAN SILVERBERRY

   HEIGHT MIX
   50% 12" HEIGHT MIN.
   50% 24" HEIGHT MIN.
4. CUT AND SPLICE GEOGRID AS NECESSARY FOR PLANTING PER MANUFACTURER'S RECOMMENDATIONS.

SEED MIX			
APPLICATION RATE: 3 LBS/1,000 SF			
NAME	PROPORTION BY WEIGHT	PURITY	GERMINATION
ARCTARED FESCUE (FESTUCA RUBRA)	30%	90%	85%
BERING HAIRGRASS (DESCHAMPSIA BERINGENSIS)	30%	90%	85%
NOOTKA LUPINE (LUPINUS NOOTKATENSIS)	20%	85%	95%
FRINGED SAGEBRUSH (ARTEMISIA FRIGIDA)	10%	90%	70%
DWARF COLUMBINE (AQUILEGIA VULGARIS)	5%	85%	90%
WHITE YARROW (ACHILLEA MILLEFOLIUM VAR MILLEFOLIUM)	5%	70%	85%

REVISIONS

REV	DATE	DESCRIPTION	BY

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2ND ST & ADAMS AVE SNOW STORAGE SITE IMPROVEMENTS
CORDOVA, ALASKA

LANDSCAPE PLAN

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT 61609-02
DATE 02/19/2016

SHEET
C-5

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Appendix C:
2nd & Adams Streets Snow Storage Site Improvements design drawings

COPPER RIVER WATERSHED PROJECT

Appendix C

ODIAK POND "MOSSY FIELD" SITE IMPROVEMENTS, CORDOVA, ALASKA

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

LOCATION MAP
NTS

ABBREVIATIONS

AVE	–	AVENUE
BBQ	–	BARBECUE
BP	–	BEGIN POINT
℄	–	CENTERLINE
ELEV	–	ELEVATION
EP	–	END POINT
GCI	–	GCI CABLE
HORIZ	–	HORIZONTAL
MAX	–	MAXIMUM
ME	–	MATCH EXISTING
MIN	–	MINIMUM
NTS	–	NOT TO SCALE
OHW	–	ORDINARY HIGH WATER
OGS	–	OIL/GRIT SEPARATOR
UE	–	UNDERGROUND ELECTRICAL
U TEL	–	UNDERGROUND TELEPHONE

LEGEND

PROPOSED / EXISTING

- SURVEY MONUMENT
- SIGN
- LIGHT
- GCI CABLE
- UNDERGROUND TELEPHONE
- WATER LINE
- CULVERT
- EDGE OF WATER
- ROAD EDGE
- GRAVEL EGDE
- CONTOURS MAJOR(5)
- CONTOURS MINOR(1)
- WOODY VEGETATION
- GRAVEL PATH
- FENCE
- EASEMENT
- PROPERTY LINE
- RIP RAP
- SURFACE COURSE, D-1
- TOPSOIL AND SEED
- EROSION CONTROL GEOTEXTILE

SHEET INDEX

C1 COVER SHEET
C2 SURFACE TREATMENT & SURVEY CONTROL
C3 GRADING PLAN
C4 PROFILES
C5 SECTIONS AND DETAILS

VICINITY MAP
NTS

SPECIFICATIONS:

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GENERAL NOTES:

1. SURVEY INFORMATION WAS PROVIDED BY ST DENNY SURVEYING, INC. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF ALL SITE FEATURES. IF THE CONTRACTOR SHOULD ENCOUNTER CONDITIONS OTHER THAN THOSE SHOWN ON ALL THE PLANS, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATIVE.
2. PLANS MAY NOT SHOW ALL EXISTING UTILITIES ON SITE. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. FOR UTILITY LOCATES, CALL (907)424-6100 OR FAX REQUEST TO (907)424-6120.
3. UTILITIES ARE ANTICIPATED WITHIN LIMITS OF EXCAVATION. COORDINATE UTILITY RELOCATION WITH UTILITY PROVIDER. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING UTILITIES AND STRUCTURES AND SHALL EXERCISE CAUTION DURING CONSTRUCTION.
4. COORDINATE CONSTRUCTION STAGING AND MOBILIZATION AREAS AND ACTIVITIES, INCLUDING DAILY WORK SCHEDULES, WITH OWNER'S REPRESENTATIVE, CITY OF CORDOVA PARKS AND RECREATION DEPARTMENT, AND CORDOVA COMMUNITY MEDICAL CENTER STAFF. DO NOT BLOCK EMERGENCY VEHICLES AT ANY TIME. ADDITIONAL PARK IMPROVEMENTS MAY BE SCHEDULED.
5. CONTRACTOR TO MEET WITH OWNER'S REPRESENTATIVE TO FLAG PAVILION AND BARBECUE LOCATION PRIOR TO MOVING.
6. SCHEDULE WORK SO AS NOT TO INTERFERE WITH FOOTRACE PLANNED FOR JUNE 18, 2015. DO NOT BLOCK PARKING, PAVILION ACCESS, OR PARK ACCESS BETWEEN 10 AM JUNE 17 AND 3 PM JUNE 19, 2015.
7. EXCAVATION AND BACKFILL:
   A. DO NOT PLACE EXCESS AND/OR UNSUITABLE MATERIAL EXCAVATED DURING CONSTRUCTION ADJACENT TO OR IN ODIAK POND.
   B. CARE SHALL BE TAKEN NOT TO IMPACT EXISTING STRUCTURES AND TO MAINTAIN WORK ACTIVITIES OUTSIDE OF ODIAK POND.
7. ALL VEGETATION IN THE AREAS NOT AFFECTED BY WORK SHALL BE PRESERVED AND PROTECTED BY THE CONTRACTOR. PROTECT EXISTING BRUSH AND TREES IN PLACE.
8. MAINTAIN ALL WORK ACTIVITIES AND DISTURBANCE OUTSIDE OF ODIAK POND, AS INDICATED BY THE "EDGE OF WATER" LINE DENOTING ORDINARY HIGH WATER. ORDINARY HIGH WATER ELEVATION OF ODIAK POND IS 17.7 FEET.
9. ALL CONSTRUCTION DEWATERING IS INCIDENTAL TO PAY ITEM 203(3) UNCLASSIFIED EXCAVATION.
10. DO NOT PUMP OR OTHERWISE DIVERT DEWATERING EFFLUENT INTO SURFACE WATER BODIES UNLESS REQUIRED PERMITS ARE OBTAINED FROM APPLICABLE AGENCIES.
11. MAINTAIN THE DEWATERING OPERATIONS TO ENSURE RETURN FLOW DOES NOT EXCEED STATE OF ALASKA WATER QUALITY STANDARDS. PROVIDE A DISPOSAL SITE FOR EXCESS WATER. TURBID WATER PUMPED FROM THE WORK SIDE MAY REQUIRE ADDITIONAL FILTRATION BY FILTER FABRICS OR OTHER METHODS TO PREVENT TURBID WATER FROM DIRECTLY ENTERING SURFACE WATER BODIES.

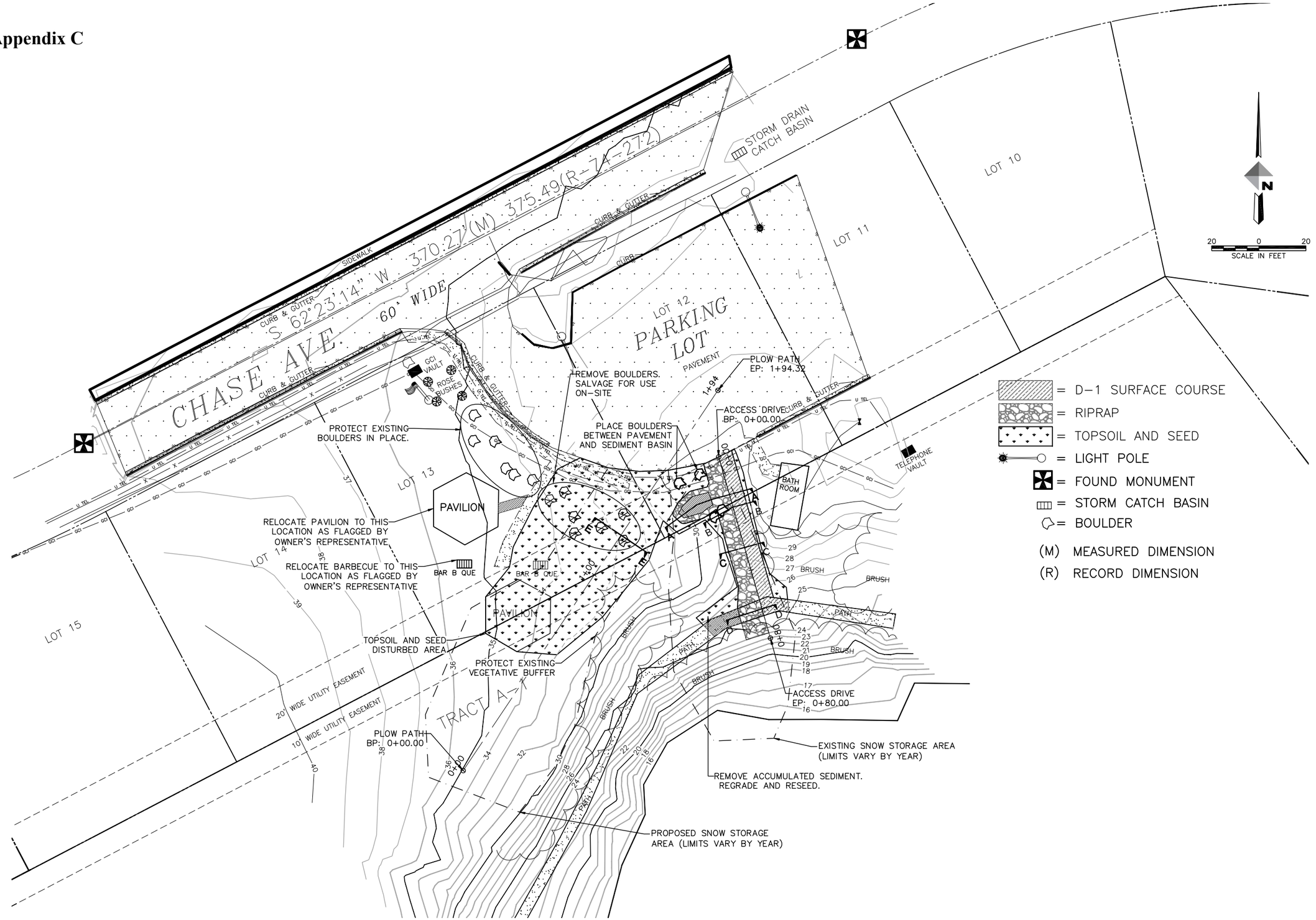
SOIL STABILIZATION NOTES:

1. SALVAGED VEGETATIVE MAT MAY BE USED IN LIEU OF TOPSOIL AND SEED. DESIRED MINIMUM MAT THICKNESS IS 6 TO 9 INCHES. WATER VEGETATIVE MAT AS NECESSARY TO MAINTAIN PLANT HEALTH UNTIL PROJECT IS COMPLETE.
2. PLACE STOCKPILED VEGETATIVE MAT AND STOCKPILED USEABLE EXCAVATION ON FABRIC, TARP, OR SIMILAR TO MINIMIZE DAMAGE TO UNDERLYING VEGETATION.
3. COORDINATE WITH COPPER RIVER WATERSHED PROJECT (CRWP) REGARDING REVEGETATION. CRWP MAY BE PLACING ADDITIONAL PLANTINGS AT TIME OF CONSTRUCTION.
4. RESEED DISTURBED AREAS WITH THE FOLLOWING MIX: 50% 'SOURDOUGH' BLUEJOINT REEDGRASS, (TRADE NAME: "ARCTIC MULCH") CALAMAGROSTIS CANADENSIS AND 50% ANNUAL RYEGRASS, LOLIUM PERENNE SSP. MULTIFLORUM.
5. APPLY 1.0 POUND SEED WITH 7.0 LBS. OF 20/20/10 FERTILIZER PER 1,000 SQUARE FEET.
6. USE SALVAGED ROCKS TO CONSTRUCT OUTLET OF SEDIMENT BASIN. PLACE FOOTER ROCKS BEHIND AND BELOW OUTLET BOULDERS.
7. COMPACT D-1 SURFACE COURSE ON TRAIL. TAMP MATERIAL AT BOTTOM OF SEDIMENT BASIN INTO PLACE BUT DO NOT COMPACT TO 95% MAX DENSITY.

PREPARED BY:
DOWL
4041 B STREET ANCHORAGE, ALASKA 99503
907-562-2000 www.dowl.com

PREPARED FOR:
COPPER RIVER WATERSHED PROJECT

Appendix C



REVISIONS

REV	DATE	DESCRIPTION	BY

STATE OF ALASKA
JEREMY M. WELCH
CE 11098
REGISTERED PROFESSIONAL ENGINEER
12/31/15

DOWL
WWW.DOWL.COM

ODIAK POND "MOSSY FIELD" SITE IMPROVEMENTS
CORDOVA, ALASKA

SURFACE TREATMENT & SURVEY CONTROL

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT 61609-01
DATE 02/14/2015

SHEET
C-2

DOWL FILE No. XXX-XX

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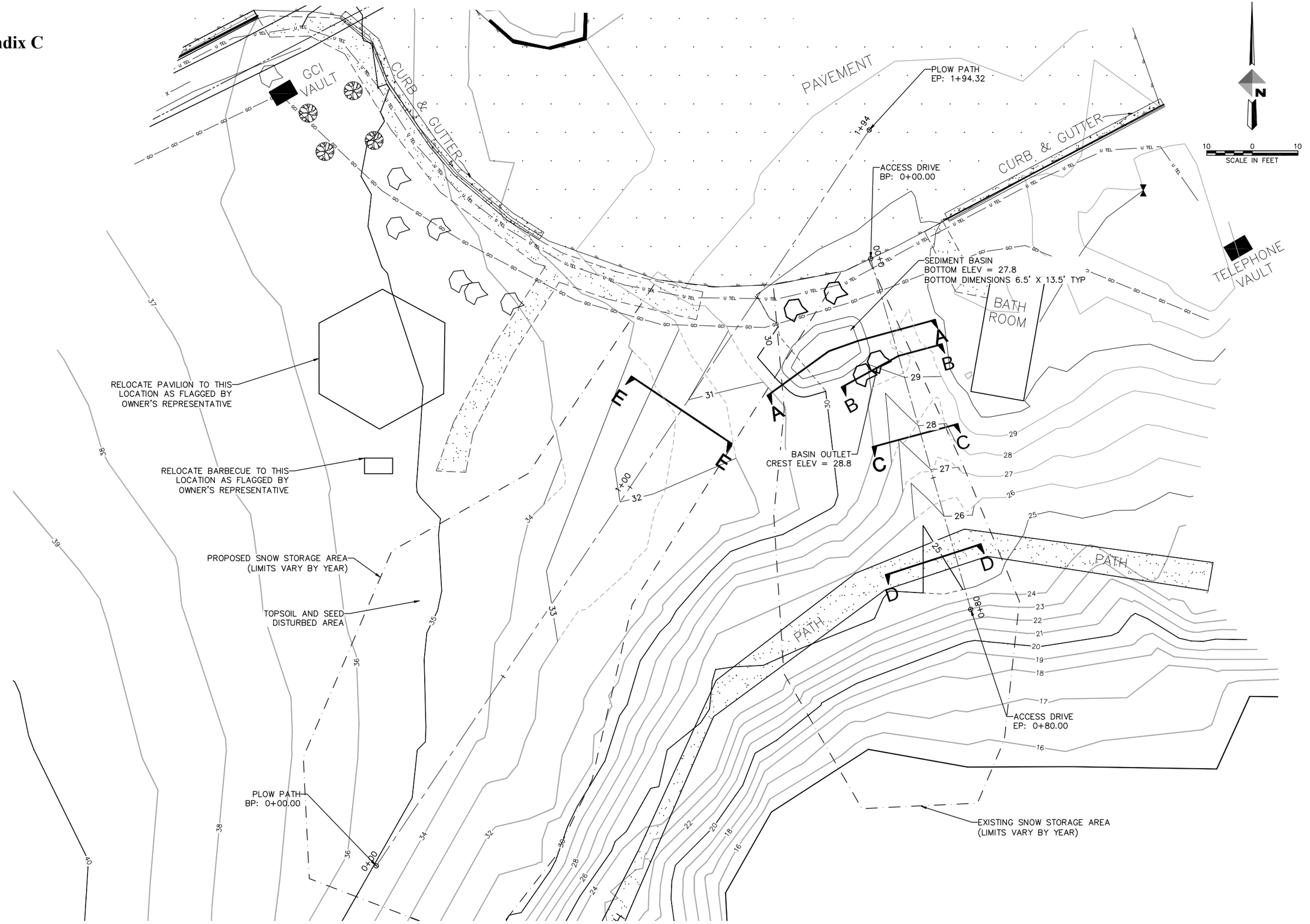
Appendix C



REVISIONS

REV	DATE	DESCRIPTION	BY

STATE OF ALASKA — REGISTERED PROFESSIONAL ENGINEER — BRADLEY M. MELOCIK — CE 11098 — 4/30/15

DOWL — WWW.DOWL.COM

ODIAK POND "MOSSY FIELD" SITE IMPROVEMENTS
CORDOVA, ALASKA
GRADING PLAN

SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT 61609-01
DATE 02/14/2015

SHEET
C-3

DOWL FILE No: XXX-XX

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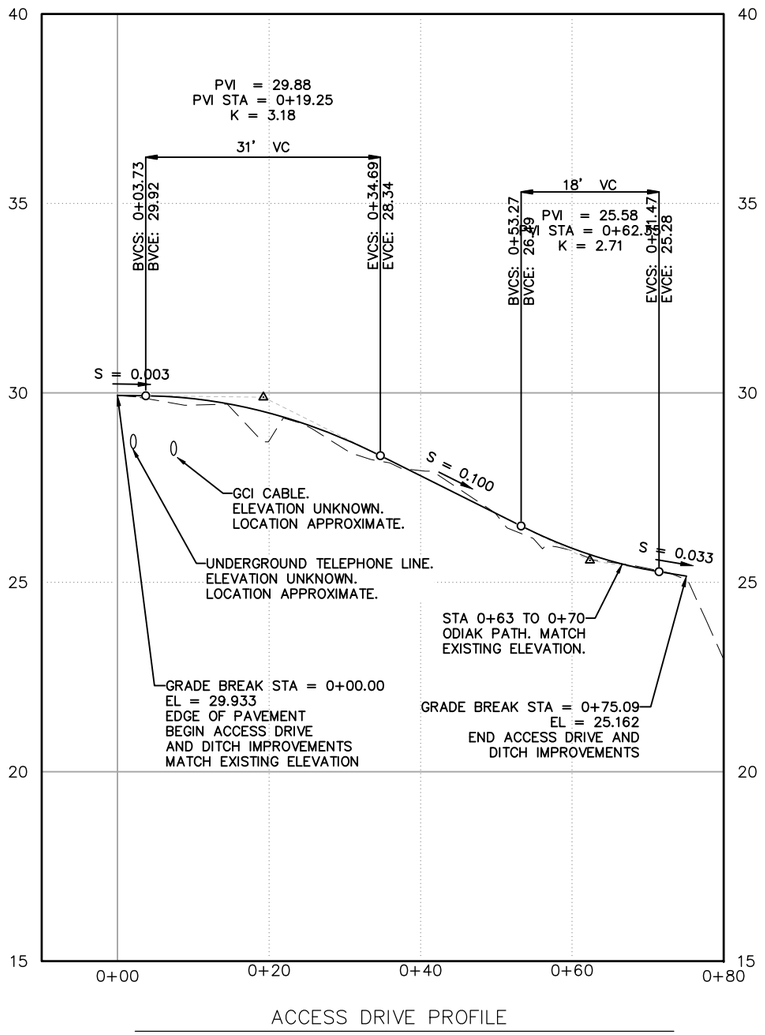
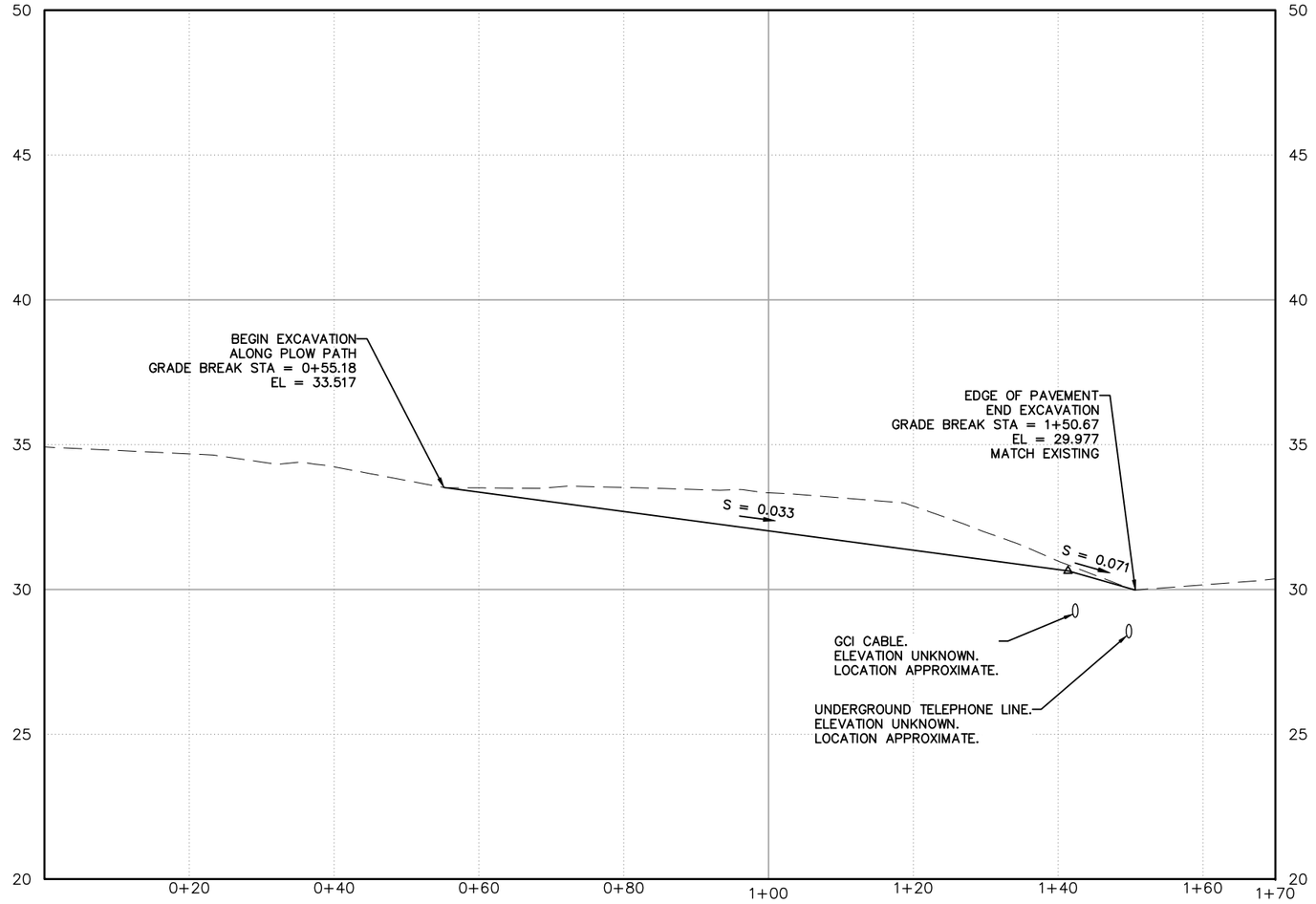


ACCESS DRIVE PROFILE



PLOW PATH PROFILE

NOTES:

1.
2. VERTICAL CURVES SHOWN ARE APPROXIMATE. ADJUST TO MATCH ELEVATIONS OF TIE-IN POINTS. MAXIMUM SLOPE OF ACCESS DRIVE NOT TO EXCEED 10%.
3. PROJECT AREA INTERSECTS A KNOWN CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL SITE. INERT WASTE MAY BE ENCOUNTERED DURING EXCAVATION. INERT MATERIALS DO NOT REQUIRE SPECIAL REPORTING OR DISPOSAL.
4. THE ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION (ADEC) HAS NO RECORDS OF CONTAMINATION ASSOCIATED WITH THIS C&D DISPOSAL AREA. NOTIFY ADEC SPILL PREVENTION AND RESPONSE AT (907) 269-3063 (1-800-478-9300 OUTSIDE NORMAL BUSINESS HOURS) IMMEDIATELY IF SUSPECTED HAZARDOUS MATERIALS ARE ENCOUNTERED.
5. CONTACT ADRIAN SMITH (907) 424-2345 AT CORDOVA TELEPHONE COOPERATIVE AND BRETT BRADFORD AT (907) 423-0300 OR (907) 424-7317 AT GCI TO COORDINATE WORK NEAR UTILITIES.

10 0 10
SCALE IN FEET

REVISIONS

REV	DATE	DESCRIPTION	BY

DOWL

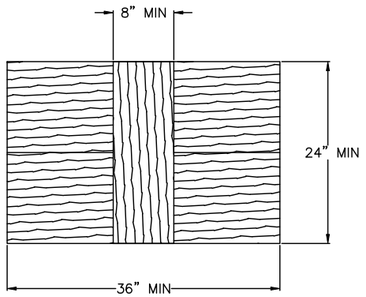
ODIAK POND "MOSSY FIELD" SITE IMPROVEMENTS
CORDOVA, ALASKA

PROFILES

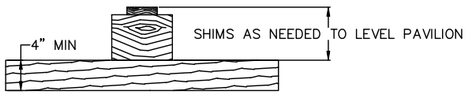
SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT	61609-01
DATE	02/14/2015

SHEET
C-4

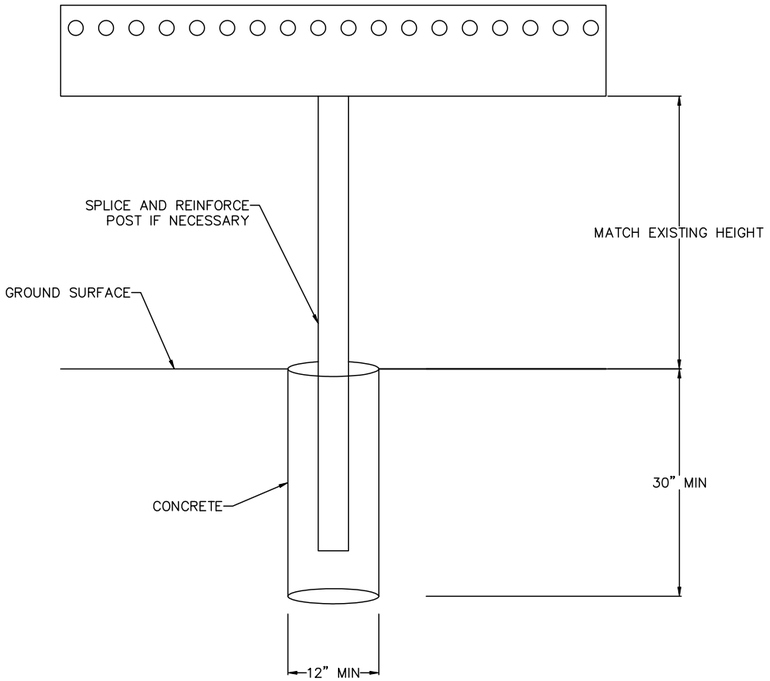


1 C3 RECOMMENDED PAVILION FOUNDATION - PLAN VIEW
NTS

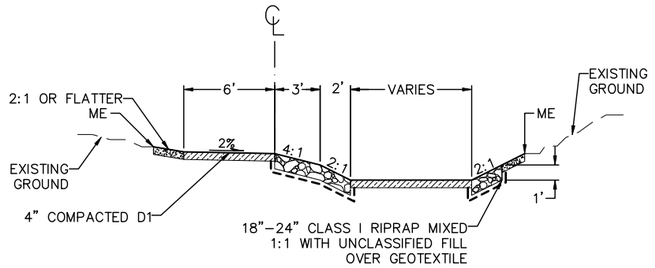


NOTES:
1. PROVIDE 6 SQUARE FEET OF CONTACT SURFACE AREA AT BASE OF PAVILION FOUNDATION.
2. CONSTRUCT FOUNDATIONS FROM TREATED LUMBER. OTHER MATERIALS MAY BE USED UPON APPROVAL OF ENGINEER.
3. WIDTH OF ANY SHIM MUST BE EQUAL TO OR GREATER THAN HEIGHT OF SHIMS STACKED ON TOP.

2 C3 RECOMMENDED PAVILION FOUNDATION - ELEVATION VIEW
NTS

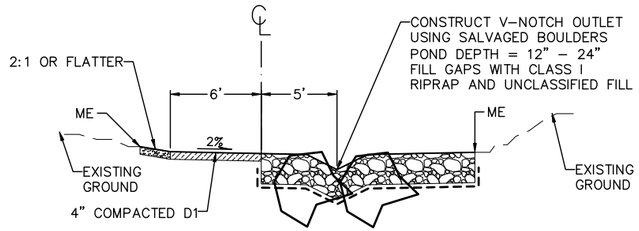


3 C3 BARBEQUE FOUNDATION - ELEVATION VIEW
NTS



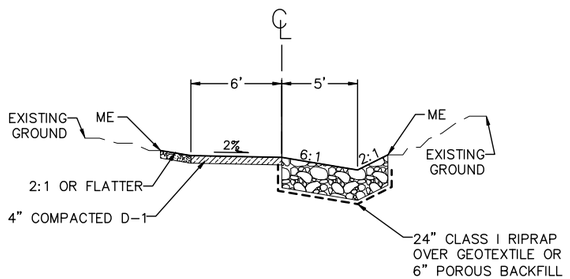
SECTION A-A - ACCESS DRIVE SECTION AT SEDIMENT BASIN

TRANSITION FROM C–C 0+09 TO 0+14
APPLIES 0+14 TO 0+21
TRANSITION TO B–B 0+21 TO 0+23



SECTION B-B - ACCESS DRIVE SECTION AT BASIN OUTLET

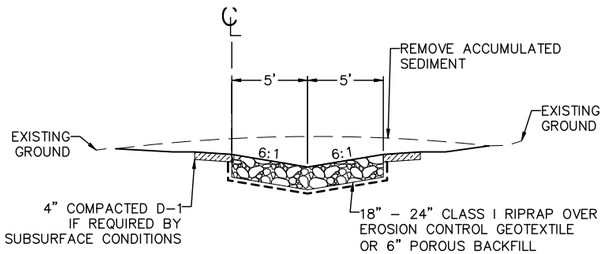
TRANSITION FROM A–A 0+21 TO 0+23
APPLIES 0+23 TO 0+25
TRANSITION TO C–C 0+25 TO 0+30



SECTION C-C - ACCESS DRIVE AND DITCH TYPICAL SECTION

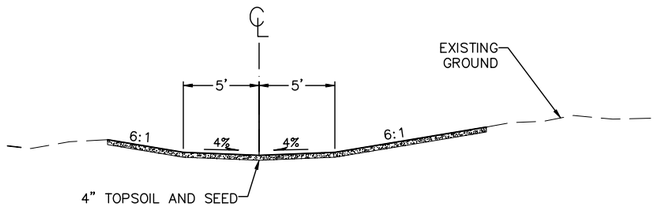
TRANSITION FROM EXISTING 0+00 TO 0+05
APPLIES 0+05 TO 0+09
TRANSITION TO A–A 0+09 TO 0+14

TRANSITION FROM B–B 0+25 TO 0+30
APPLIES 0+30 TO 0+55
TRANSITION TO D–D 0+55 TO 0+63



SECTION D-D - ACCESS DRIVE DITCH ACROSS PATH

TRANSITION FROM C–C 0+55 TO 0+63
APPLIES 0+63 TO 0+70
TRANSITION TO EXISTING 0+70 TO 0+75



SECTION E-E - PLOW PATH

TYPICAL FOR LENGTH OF IMPROVEMENT ALONG PLOW PATH

REVISIONS

REV	DATE	DESCRIPTION	BY

STATE OF ALASKA 49TH — BRADLEY M. MELOCK — CE 11098 — REGISTERED PROFESSIONAL ENGINEER — 02/14/15

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ODIAK POND "MOSSY FIELD" SITE IMPROVEMENTS
CORDOVA, ALASKA
SECTIONS AND DETAILS
SECTION 28, TOWNSHIP 15 SOUTH, RANGE 3 WEST
COPPER RIVER MERIDIAN, ALASKA

PROJECT	61609-01
DATE	02/14/2015

SHEET
C–5

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