LOWE RIVER LEVEE SYSTEM

VALDEZ, ALASKA

OPERATION, MAINTENANCE & REPAIR (OMR) MANUAL

Prepared by:

City of Valdez
Capital Facilities Department,
Public Works Department &
Community Economic Development Department

JANUARY 2016

Contents

SECTION 1. INTRODUCTION

The purpose of this manual is to document a plan for the operation and maintenance of three Levees on the Lowe River. The manual outlines provisions for the City of Valdez to use in the repair, replacement, and rehabilitation of the Lowe River Levee System. Guidelines should be followed according to the various items and schedules identified. There may be additions or adjustments to this manual in the future as experience with the Levee reveals any unforeseen items. This manual will be updated on an annual basis to ensure that all City staff responsibilities are delegated to the appropriate personnel.

SECTION 2. PROJECT DESCRIPTION

The Lowe River Levee System is located south of the Alpine Woods and Nordic Subdivisions along the Lowe River. The Lowe River has an average monthly flow of 42-3,880 CFS, an average daily flow of 40 to 5,410 CFS, and estimated peak flow of 42,000 CFS.

The Lowe River Levee System consists of three groins constructed on the floodplain north of the main channel of the Lowe River. The upstream groin, Levee #3, was originally constructed from local materials, mainly sand and gravel. Before renovation the groin was roughly 6-8ft high with an average crest width of 10 feet and 1v:1.5h side slopes. Twelve to twenty-four inch armor rock protection was placed for roughly 100 feet at both ends of the original groin.

Levee #3 was renovated in 2013. Rip-rap design, calculations, and gradation is reported in detail in Appendix D. Lowe River Levee renovation for Groin #3 was funded by the City of Valdez, and designed and constructed by URS of Anchorage, Alaska.

The older groins, Levee #1 and #2, were constructed between 1985 and 1995. As-built drawing show the groin sections were built with a 3H:1V slope, protected with Class III rip rap armoring, and a 5 foot deep continuous buried scour toe.

Overall, the levees appear to be in good condition with no signs of settlement, cracking, seepage, displacement, or erosion. Wind, wave action, ice loading, and impact of debris are not considered threat to the older levee sections. Scour is considered a threat along an exposed outside bend of the upstream levee. In 2013 it was discovered that scour had removed a significant portion of the Class III rock near the outside bend of the upper levee at Station 135+00. A repair project in 2014 replaced 400 linear feet of Class III rip rap, including installation of a 12” Class I filter layer, and installation of a 5 foot deep continuous buried scour toe.

SECTION 3. PROJECT PERFORMANCE

The Lowe River Groins were designed as channel alignment features as the as-built documents show in Appendex A. In September 2007, the Corps of Engineers inspected the groins following the major flood event in August 2006 during which the groins sustained minimal damage to their terminal armor sections. The inspection concluded that the groins perform as designed since the groins have not sustained a significant failure and the major channels of Lowe River have not been able to migrate into either the Alpine Woods or the Nordic Subdivisions.

SECTION 4. FLOOD WATCH AND FLOOD WARNINGS

Prior to spinning up an EOC, the City of Valdez shall respond to Flood Watches & Flood Warnings using the following procedure:

The City Manager shall be informed of the current status of water levels within the City limits by 3 main departments:

POLICE DEPARTMENT (PD)	PUBLIC WORKS (PW)	FIRE DEPARTMENT (FD)
Shall coordinate notifications, collect information from and generally communicate with: Alaska State Troopers (AST) Copper Valley Electric (CVEA) Copper Valley Telephone (CVTC) Alyeska (Pipeline Terminal)	*Shall coordinate notifications, collect information from and generally communicate with:* State Dept of Transportation (DOT) Alpine Woods Community Action Team (ACAT) or appropriate AWS residents	*Shall coordinate notifications, collect information from and generally communicate with:* Hospital Schools Coast Guard (CG)

During flood watch events & heavy rain:

POLICE DEPARTMENT (PD)	PUBLIC WORKS (PW)	FIRE DEPARTMENT (FD)
Responsibilities Include: Sending patrols throughout City limits to check on water levels and water flow, esp. in designated Key Flood Risk Areas Dispatch will handle information coming in from citizens and pass it along to the appropriate dept Gather reports of current situation and keep City Manager and Public Works up to date with potential and actual problems	*Responsibilities Include:* Staging equipment and materials ahead of flooding event to ensure a proper response can be achieved if necessary Responding to infrastructure damage through filling sandbags, using heavy equipment to repair flood control structures, or other logistical needs	*Responsibilities Include:* Prepare supplies and sandbags Supply information and help to public works as needed

PREPARATION CHECKLIST

- Distribute strategic piles of sand in case the need for sand bags arises
- Locate and document amount of sandbags currently available
- Stockpile extra rip-rap and dike repair materials near AWS levees and Mineral Creek levees
- Strategically place equipment or have an agreement to use existing contractor equipment signed
- Check on and ensure there are enough emergency supplies at fire stations to support outlying subdivisions should they be cut off from town

KEY FLOOD RISK AREAS FOR PATROL

<u>Alpine Woods Subdivision (See attached Map, Appendix B)</u>

1. Levee System – Ensure all levees are not being overtopped anywhere, looks for signs of levee weakness or areas that look highly eroded.
2. Levee #3 Culvert system – Ensure culverts are not blocked with debris and are open to acceptable levels (see Appendix C)
3. Subdivision Culvert system – Check on subdivision culverts to ensure they are not blocked , continue to pass water freely, and do not appear to be reaching full /overtopping water levels.
4. Scott Caruthers Culvert (last house on the left Past 10-mile before Keystone Canyon)

This is almost entirely CITY owned infrastructure, but coordinating with and informing ACAT members of any flood preparation measures and response should be a high priority for Public Works.

SECTION 5. EMERGENCY OPERATIONS

The City of Valdez has created a detailed emergency operation plan that covers preparation for and responses to emergency operations in relation to flooding. This Emergency Operations Plan (EOP) has been developed following guidance provided in "SLG-101: Guide for All-Hazard Emergency Operations Planning" published by the Federal Emergency Management Agency (FEMA) and the National Response Plan. This plan is compliant with the National Incident Management System (NIMS), a controlled copy of the plan is located in the office of each staff member responsible for responding to EOP's.

<u>Flood Fighting Equipment and Supplies</u>

a. Fill Material
b. Class III Riprap
c. Sandbags
d. Plastic Sheathing
e. Emergency Lighting
f. Communication Systems: Motorola Radios, both hand-held and mobile units with the capability of communicating with all local responders (Police, Fire, Public-Works) as well as State Agencies
g. Electronic signs which can be deployed in the area for communication with the general public
h. Flotation Vests
i. Pumps (Two 6-inch portable pumps)
j. Heavy Equipment
   -Caterpillar 966 Frontend Loaders
   -Caterpillar D8 and D7 Dozers
   -Two Peterbilt 12 yard Dump Trucks
   -Caterpillar 730 Rock Truck

SECTION 6. MAINTENANCE AND INSPECTION

Operation and maintenance of an adequately designed groin or levee system under normal flow conditions is projected to require replacement of a maximum of about 2 or 3 percent of the total armor rock quantity per year. The actual quantity of rock replacement required may be less or significantly more than this; however this will depend on the condition of the groins after each year's break-up, the flood magnitudes experienced during the year and the erosion that has taken place. Erosion and scour may be significant in some years but may be minimal in others. The stockpile of maintenance rock should be used and replenished on an as-needed basis during the life of the levee system.

A visual inspection shall be performed annually to verify the stability and overall integrity of the levees and associated structures and systems. Visual inspections shall also be performed as needed based on high water or flooding events at the discretion of City staff. Culvert gates shall be inspected and manually exercised on an annual basis, with maintenance and repairs to culvert gates and culverts performed as needed. Height of the levees shall be surveyed every five (5) years, or as needed for all or portions of the levee system should areas of the levees be compromised by a flooding event giving reason to re-verify levee height. The height verification surveys shall be certified by a licensed surveyor or engineer in the State of Alaska. Annual levee inspections and exercising of culvert gates shall be performed by City staff. The aforementioned measures shall be documented, and a formal report shall be submitted to Valdez City Council and the appropriate regulatory agency/agencies.

Vegetation on and adjacent to the levees consists of alders and other small native shrubs as well as native grasses. Existing vegetation shall be cleared as necessary to minimize the potential for vegetation to compromise the integrity of the levee structure.

Levee armor stone replacement. Armor stone shall be replaced with similar size material as necessary to maintain structural integrity of the levees.

Levee breach. Where a levee section may be breached, the breached section shall be stabilized and re-constructed to match the existing levee section as soon as reasonably possible once potential danger of a high water or flooding event has subsided.

Culvert gates shall be inspected and manually exercised on an annual basis, with maintenance and repairs to culvert gates and culverts performed as needed.

City staff and police, with the help of local residents, monitor the local river/streams for high water events. A USGS stream, gauge has been installed in the Lowe River with real-time data streamlined to City staff and subscribed community members via text for early warning. Police Dispatch and local residents will contact appropriate City personnel to respond to a high water or flooding events.

Existing stream gauges are read when high water conditions are present. The Public Works Director or City Engineer directs the culvert gates to be closed when the stream gauge readings exceed the levels specified herein. The culvert gates are accessible during typical and even extraordinary high water or flooding events.

Individuals responsible for maintenance compliance:

1. Dennis Ragsdale, City Manager
2. Jason Miles, P.E., City Engineer / Capital Facilities Director
3. Robert Comstock, Public Works Director
4. AnnMarie Lain, Senior GIS & Planning / Certified Floodplain Manager

The maintenance program outlined above may be adjusted, as further operational experience is gained with the levee system.

Actions/Assignments/Responsibilities:

1. Dennis Ragsdale, City Manager
   a. Mr. Ragsdale provides direction to City staff and is accountable to Valdez City Council for ensuring flood control prioritization and mitigation efforts. He is responsible for public safety in the event of high water or flooding event.

2. Jason Miles, P.E., City Engineer / Capital Facilities Director
   a. Mr. Miles oversees design, installation, inspections and maintenance of flood control measures for the City of Valdez. He is responsible for ensuring regulatory agency compliance.

3. Robert Comstock, Public Works Director
   a. Mr. Comstock is responsible for direction to City maintenance crews for installation, repairs and maintenance of flood control measures, as well as emergency response to high water / flooding events. Mr. Comstock monitors river/stream conditions and coordinates with local residents and City police for high water / flooding preparedness. Mr. Comstock also oversees inspections of levees and other flood control structures/systems.

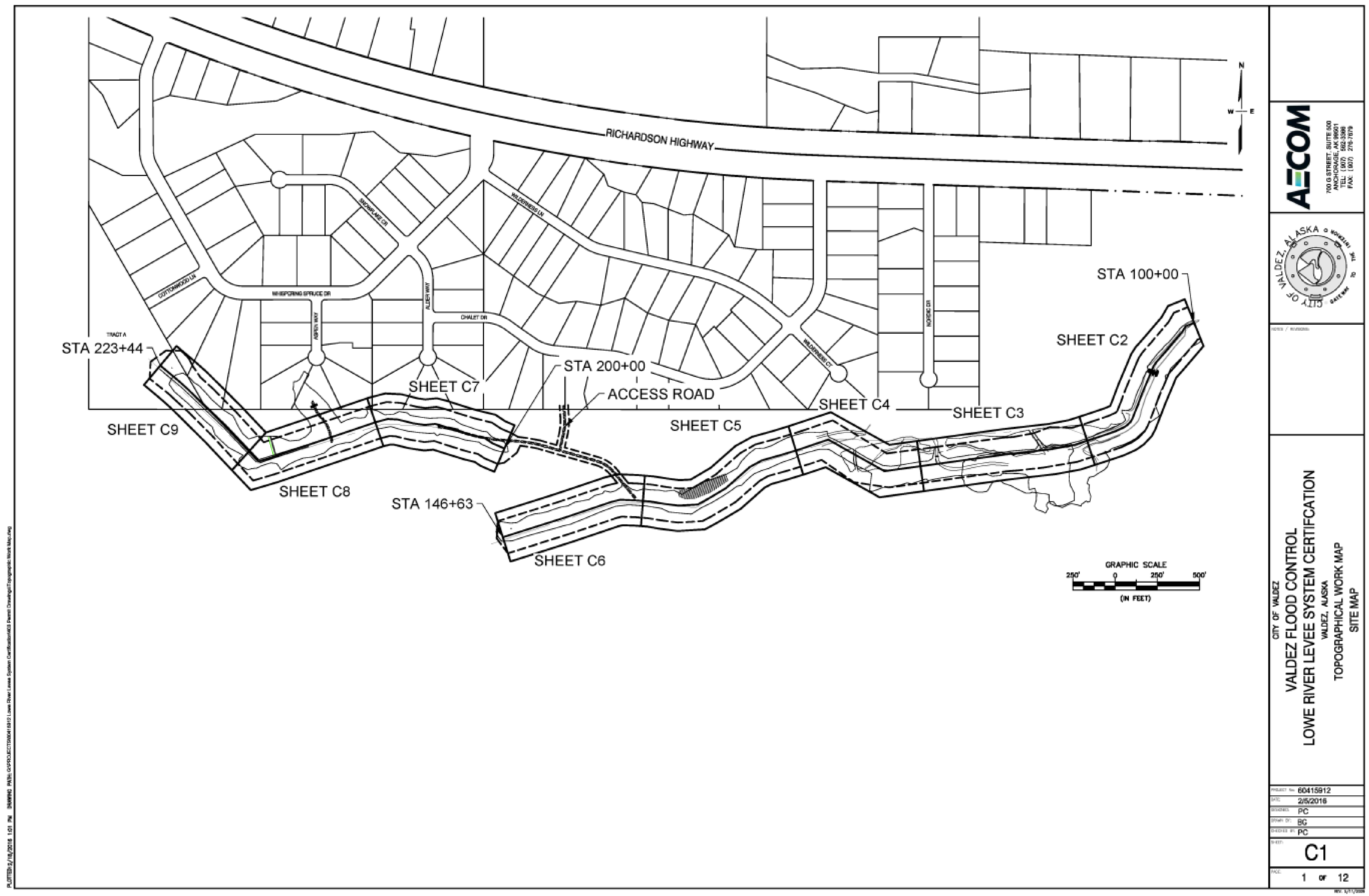
4. AnnMarie Lain, Senior GIS Technician / Certified Floodplain Manager
   a. Ms. Lain is responsible for documentation and assists with ensuring regulatory agency compliance through coordination and formal correspondence.

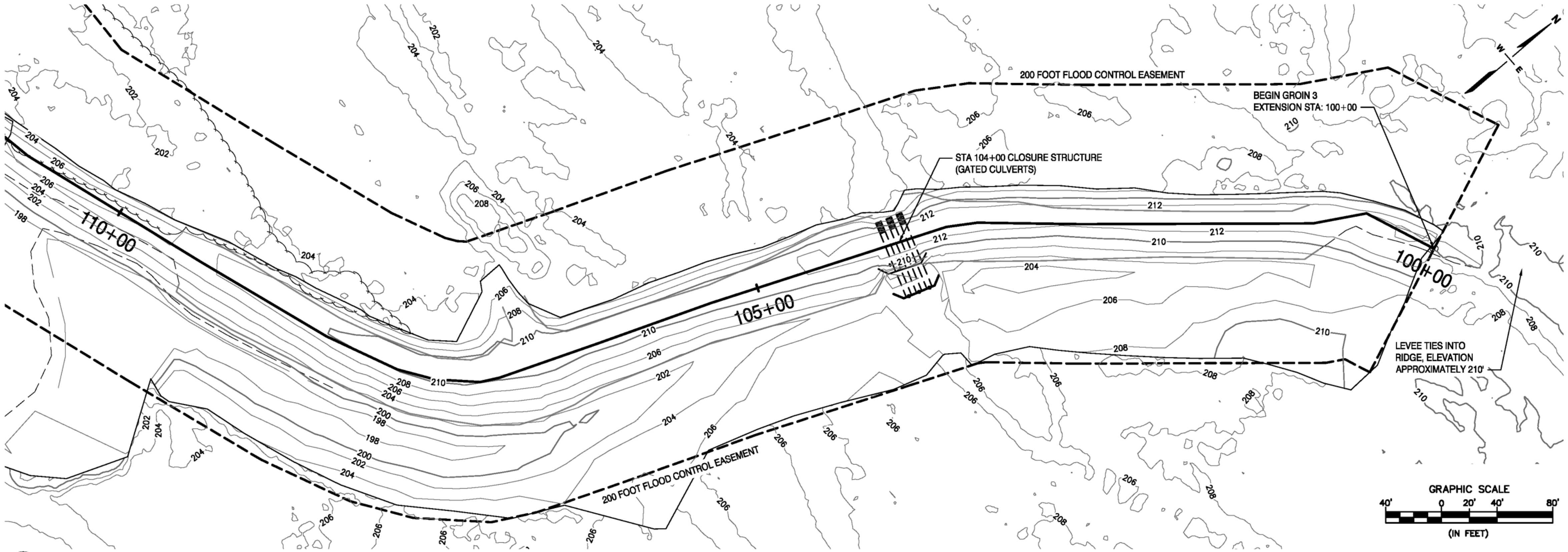
5. Scott Benda, Project Manager / Assistant Building Inspector
   a. Mr. Benda performs site inspections and provides documentation as needed.

6. Rick Wade, Local Resident
   a. Mr. Wade assists the City of Valdez with monitoring Lowe River conditions as a resident of an adjacent subdivision. He also provides construction services for dike/levee installation and repairs, especially for emergency preparedness and response.

7. Valdez City Police
   a. The police department assists with monitoring for high water in the local river/streams, contacts appropriate City personnel, and ensures public safety during flooding events.

Appendix A. Lowe River Levee System As-Builts





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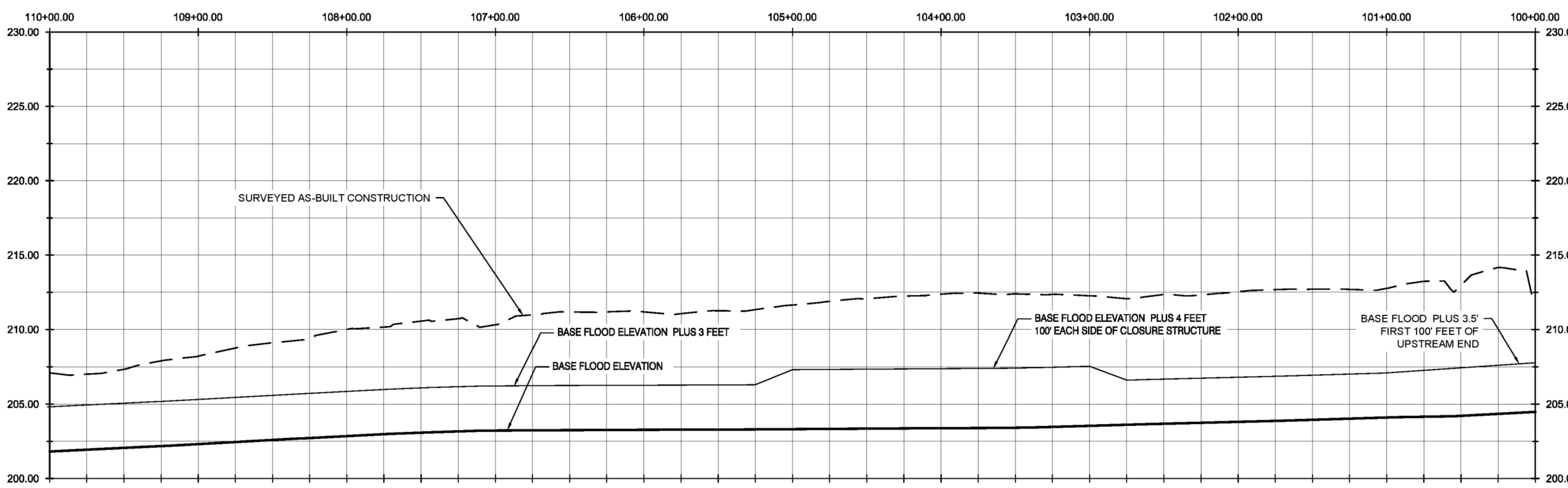

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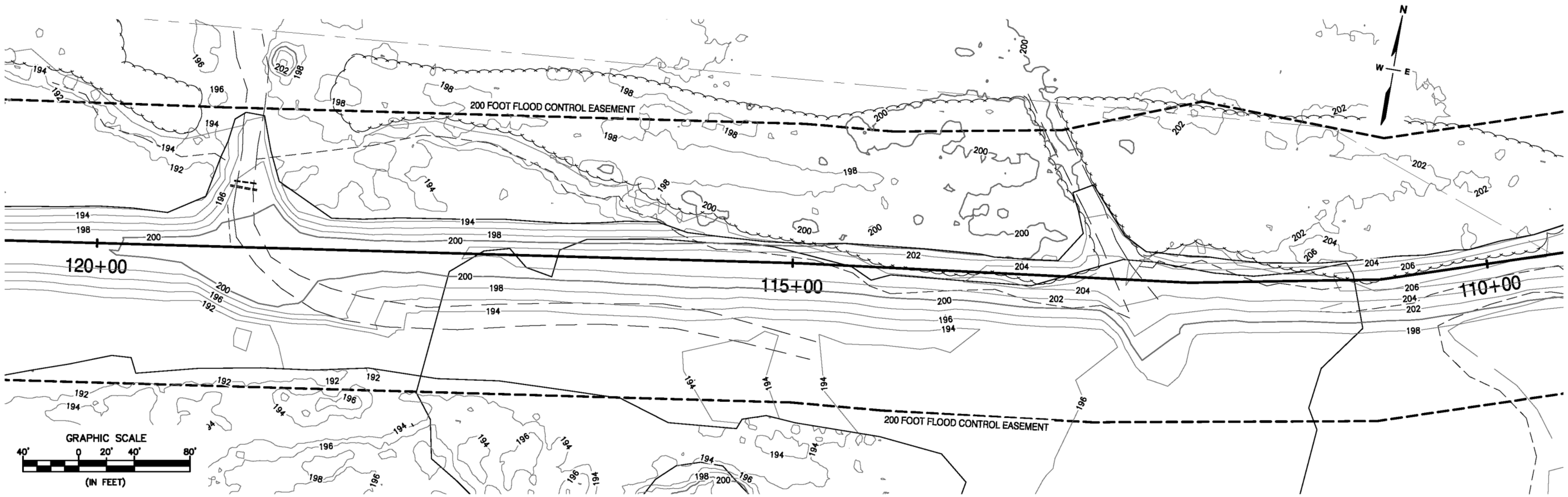

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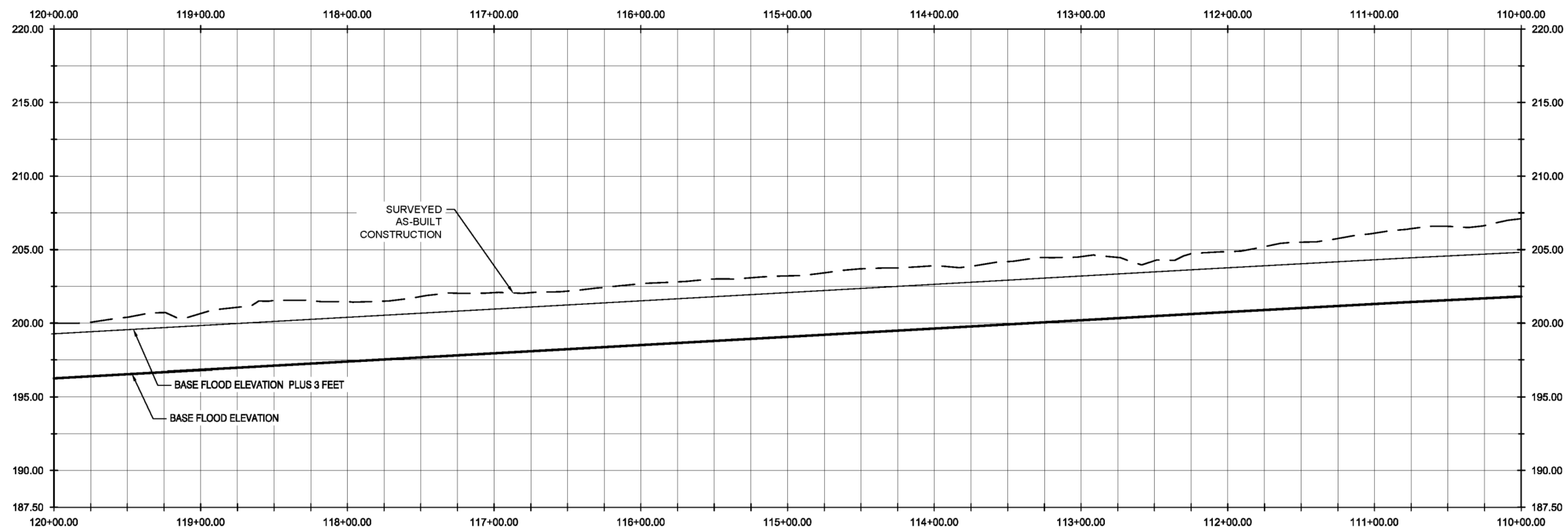

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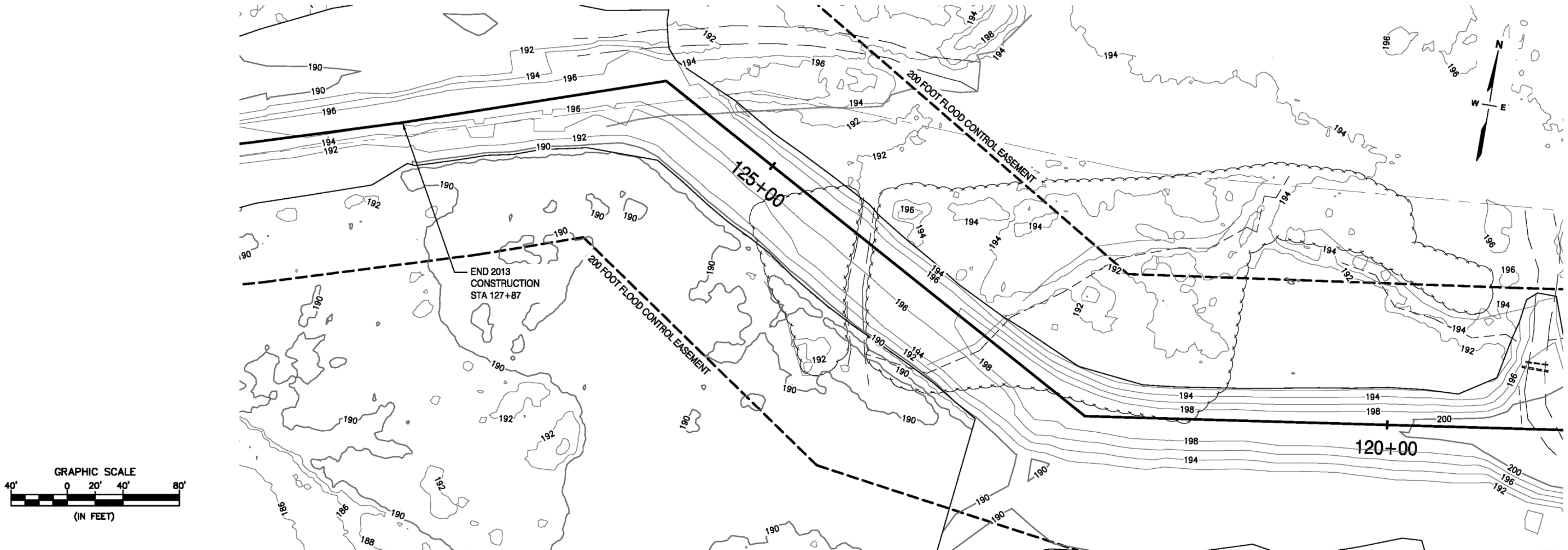

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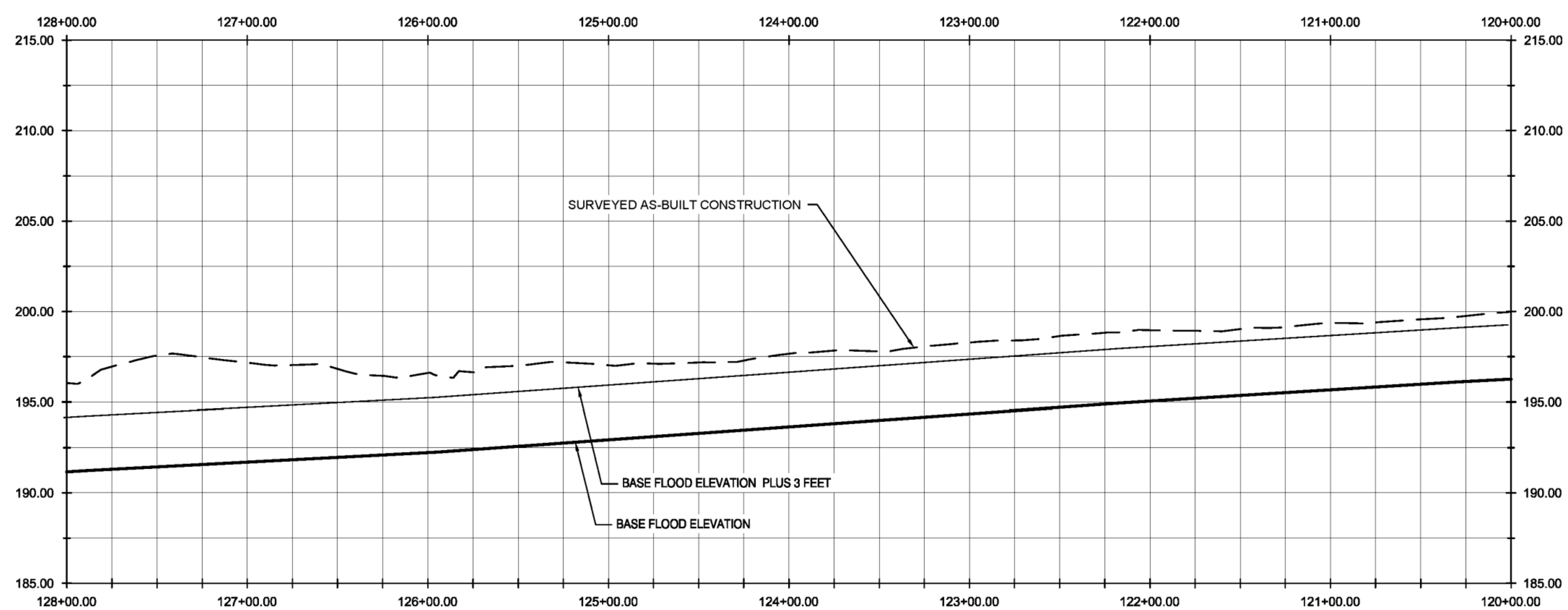

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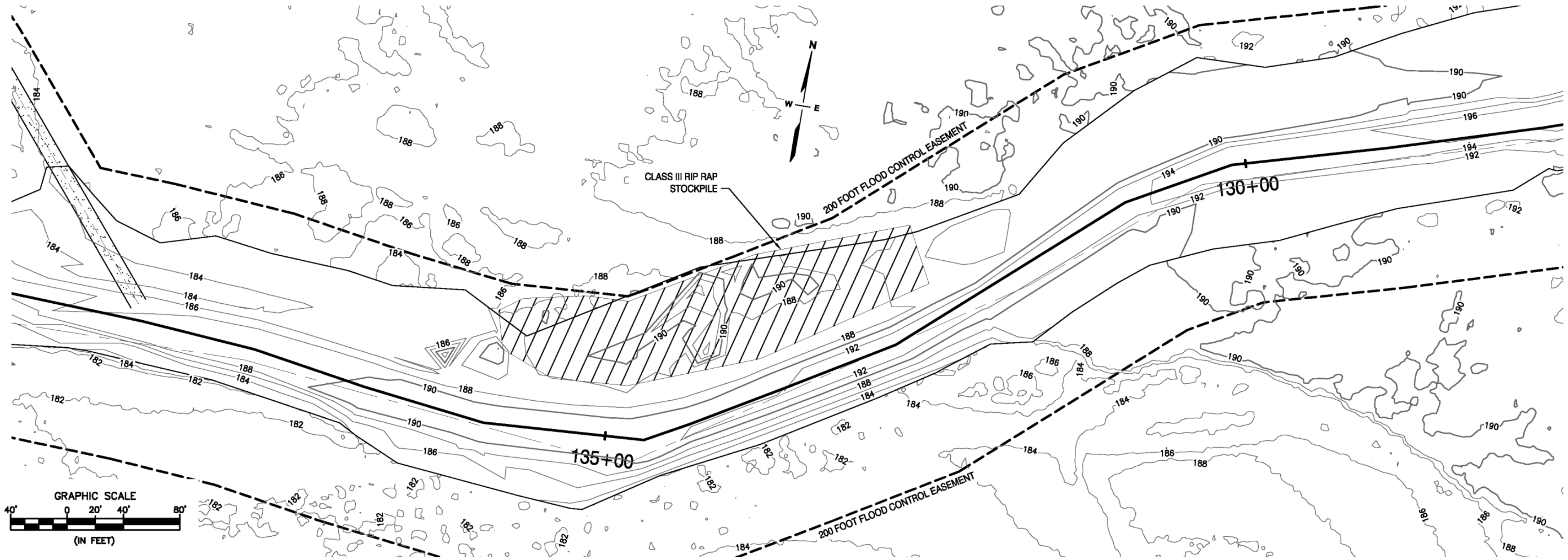

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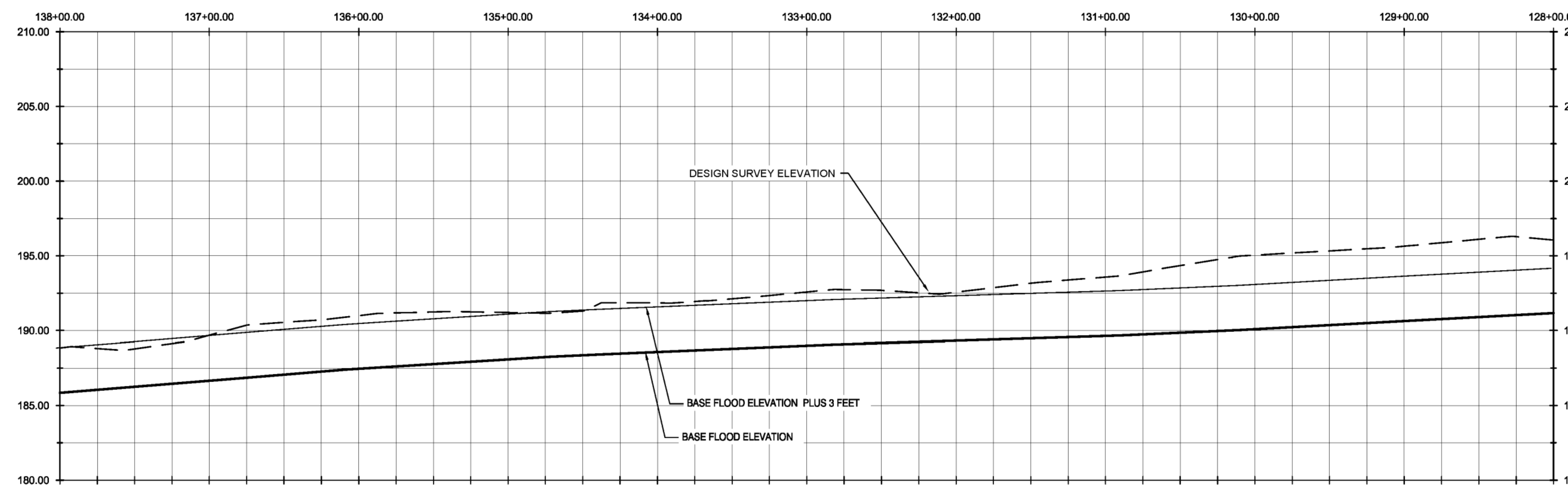

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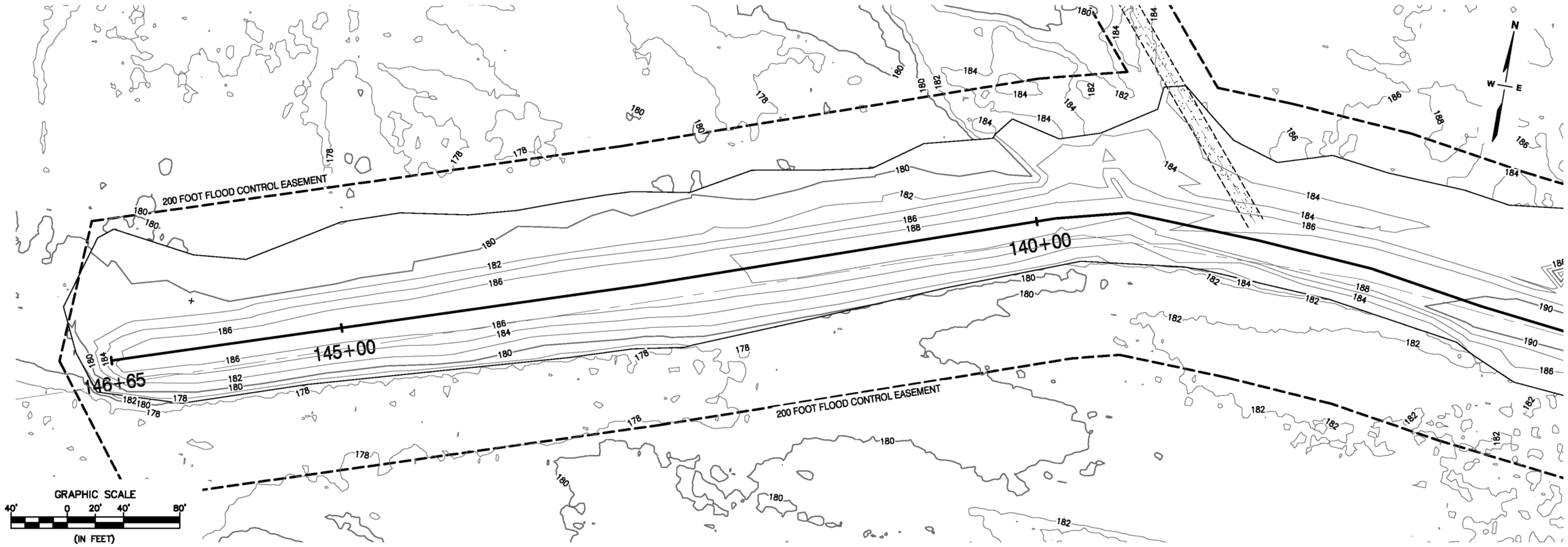

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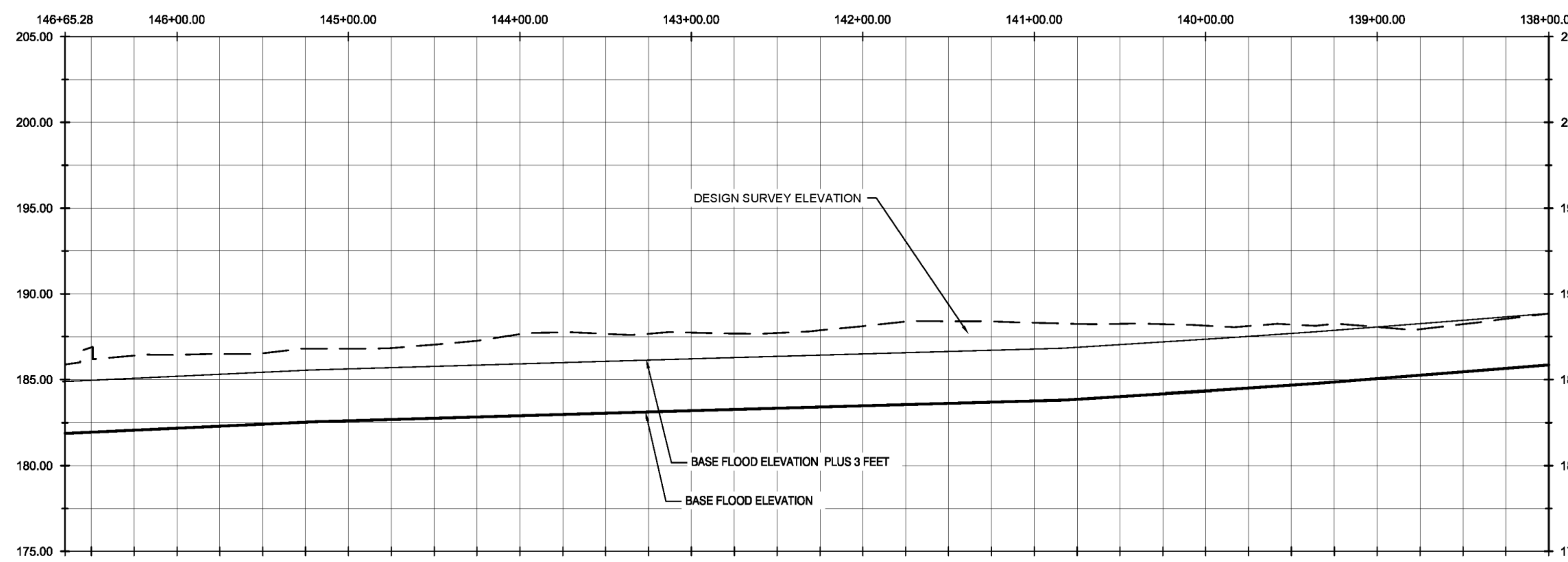

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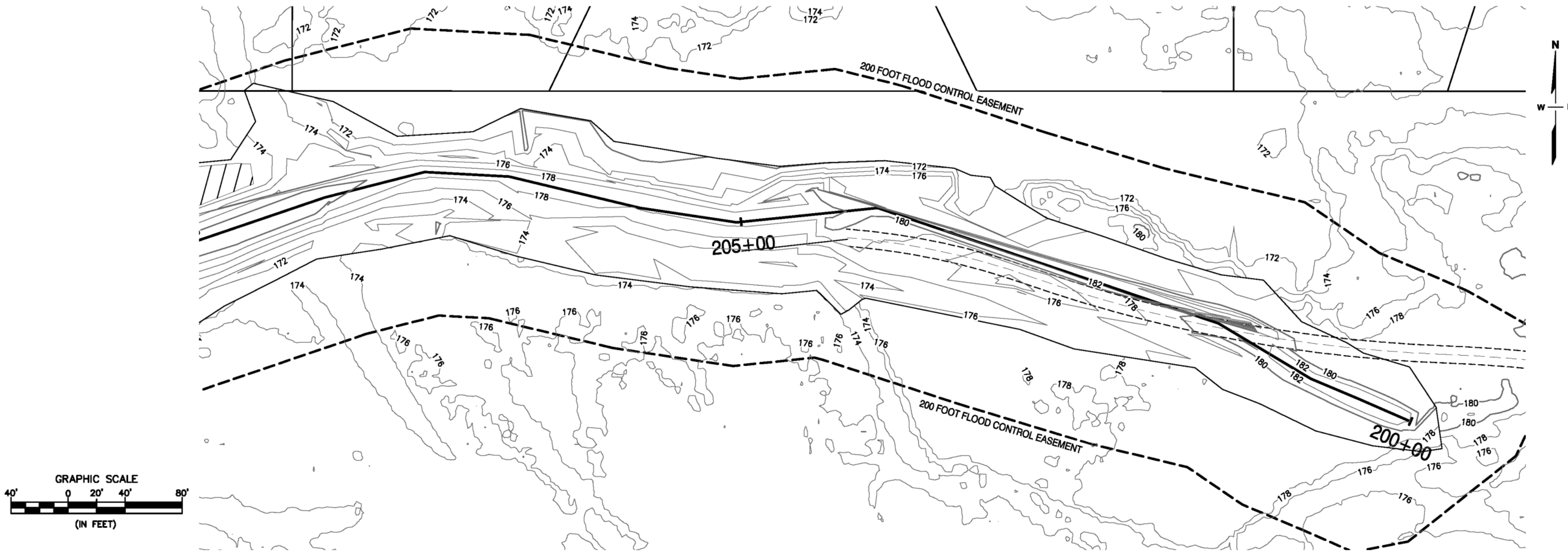

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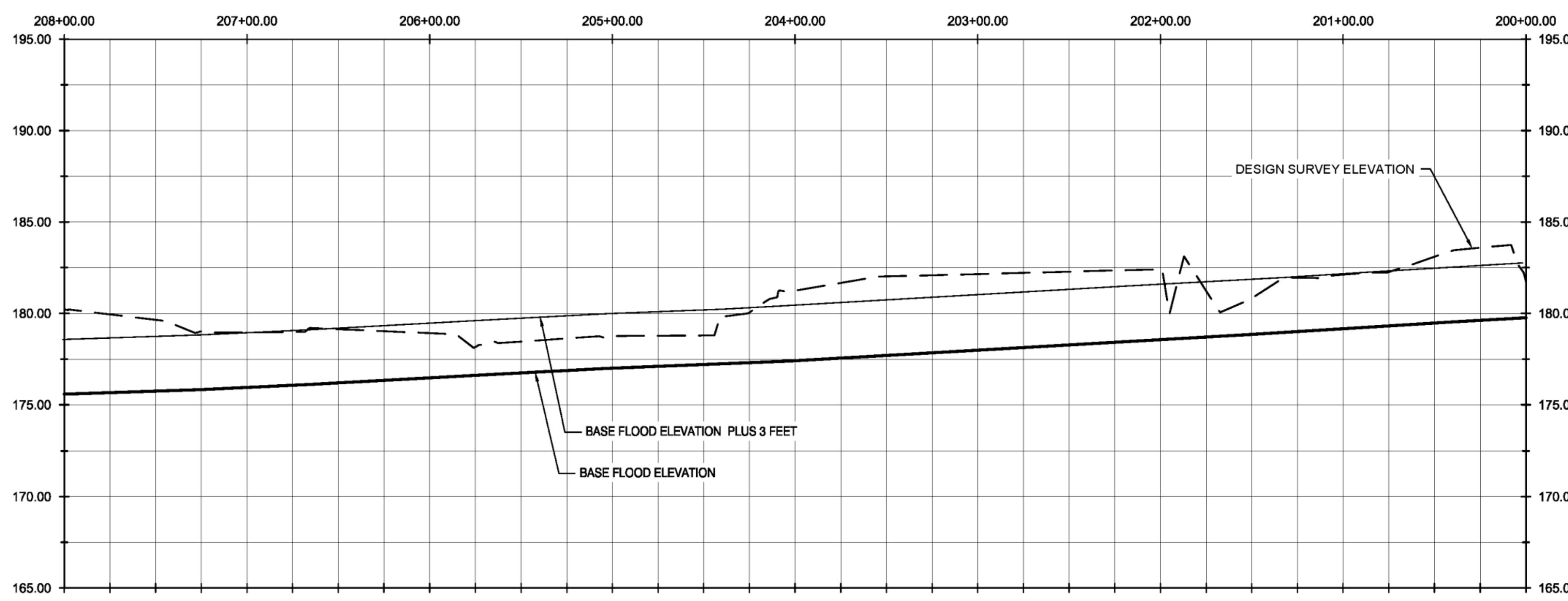

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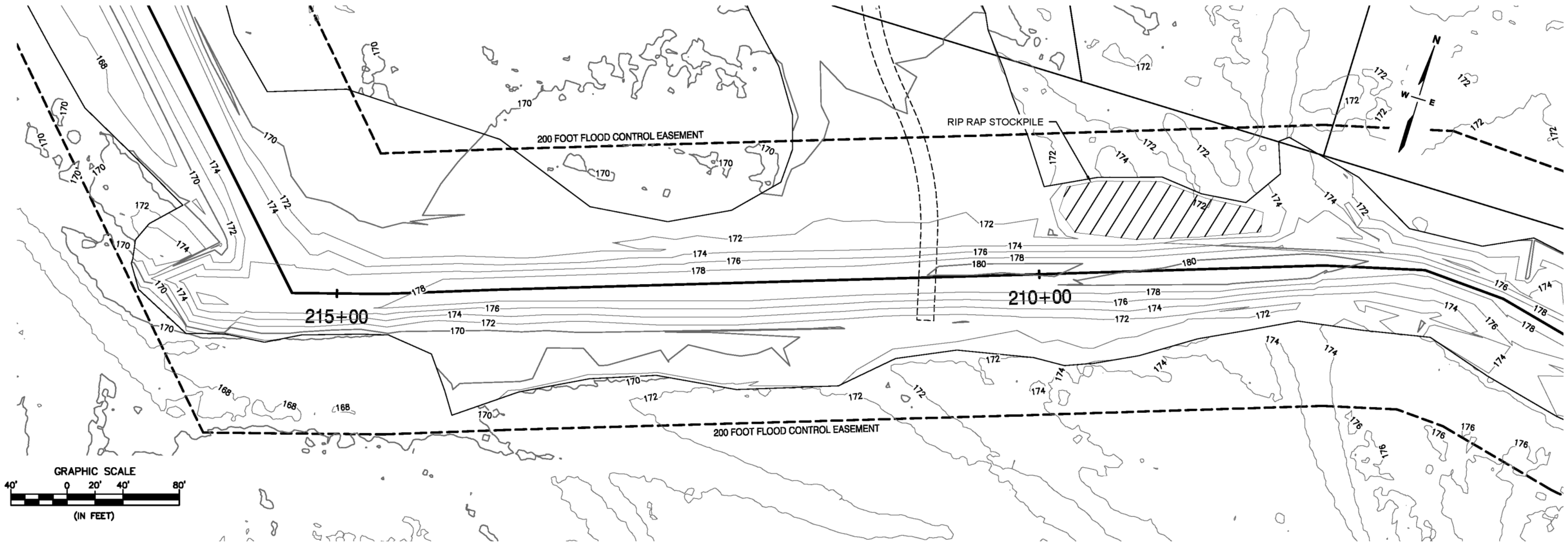

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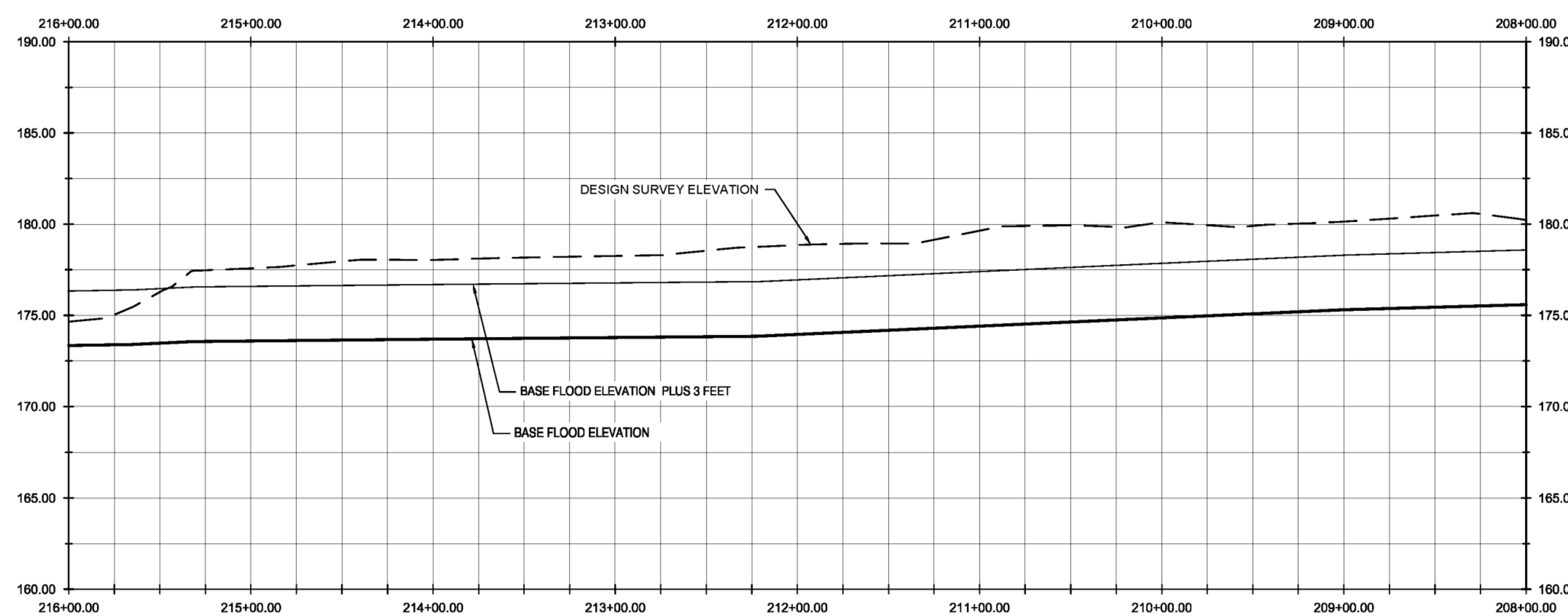

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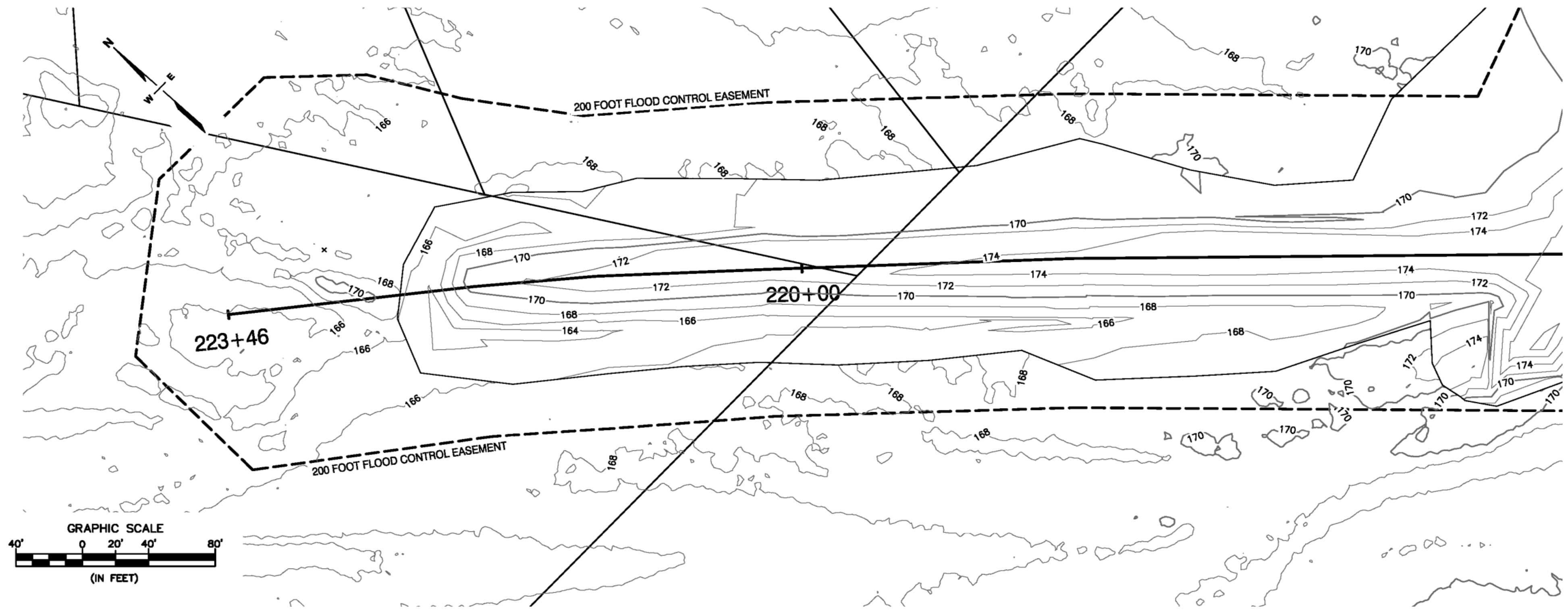

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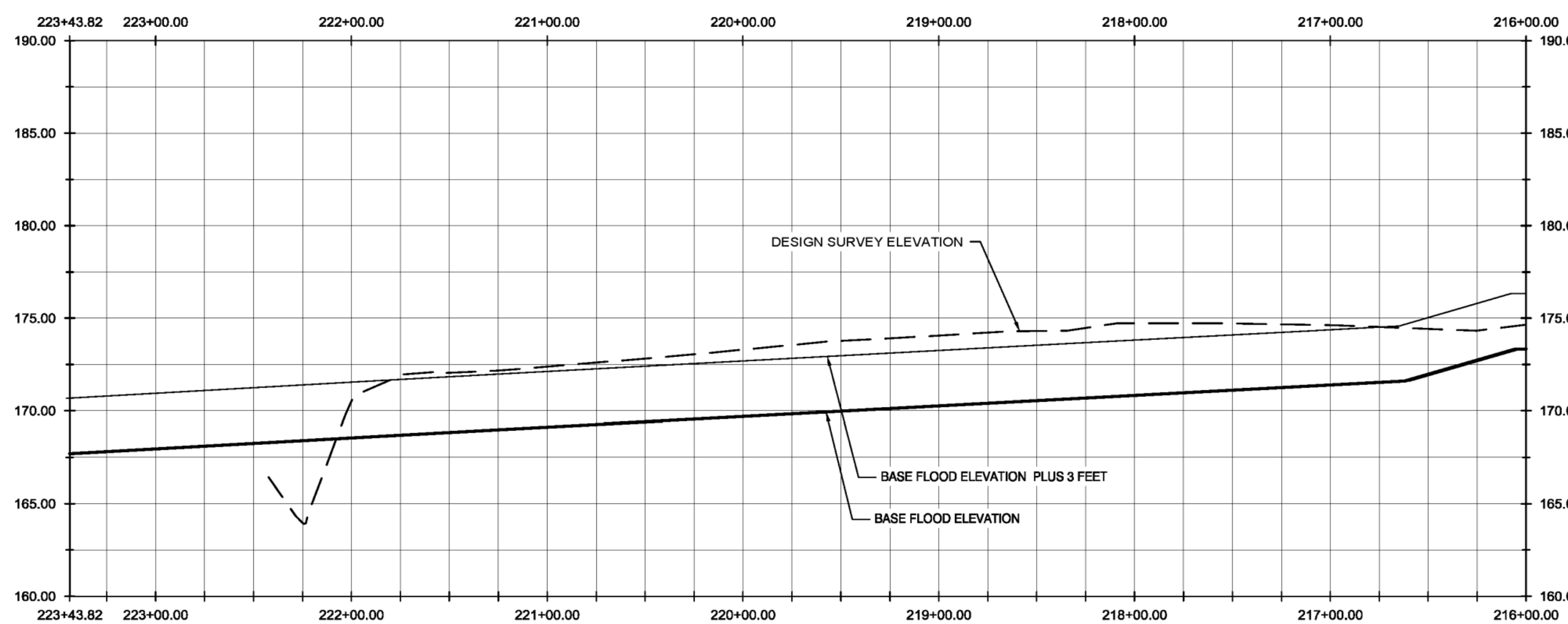

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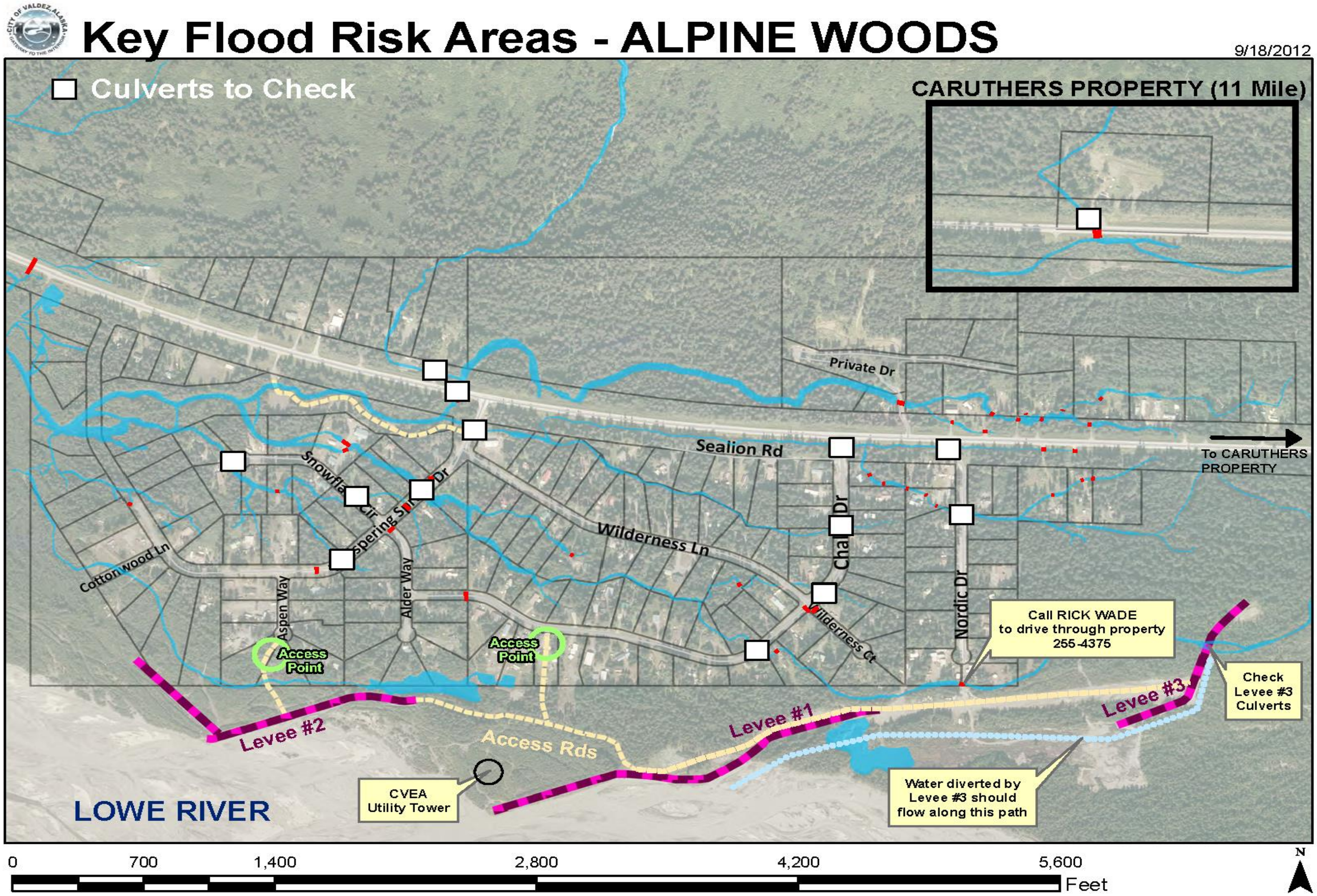
Appendix B. Key Flood Risk Areas Map



Appendix C. Culvert Operation Manual

CULVERT GATE OPERATION MANUAL

Gate in 'UP' position-culvert open
Gate in 'DOWN' position-culvert closed

Normal Water Level

During normal weather and flow conditions, **all three culvert gates should remain fully open**. The channel is listed in the Alaska *Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes* and its associated Atlas because of its importance for the spawning, rearing or migration of anadromous fish. The culvert gate structure is a permitted fish passage structure. If one or more of the gates are closed during typical summer water flow, water velocities in the open culvert(s) will increase and impede fish passage.

Rising Water Level (onset of flood)

Staff gages need to be read manually by a trained observer. Observers should be familiar with reading staff gage increments, and should be familiar with gage levels that require closure action. In the event of rising water levels, action should be taken to completely close the culvert gates when staff gage readings exceed one or both of the following water levels:

Upper Staff Gage: 2.80 feet
Lower Staff Gage: 1.80 feet

During and following an abnormally heavy precipitation event or large spring break-up runoff, an observer should check water levels at the gate structure. In the event of rising water levels, all three culvert gates should be completely closed once the readings exceed either water level.

Receding Water Level (flood recession)

At the direction of a responsible party, action to open the culvert gates can be taken following the flood peak, when water levels are actively and noticeable lowering, and when the upstream staff gage reading has lowered to the following level:

Upper Staff Gage: 2.80 feet

Following a flood where all culvert gates have been closed, operations to re-open culvert gates should proceed slowly. Only one gate should be opened at a time. Following the opening of the first gate, the operator should allow water levels downstream of the culverts to re-establish for at least 15 minutes before opening additional gates. Gates should be reclosed if the lower staff gage reading exceeds 1.80 feet. Downstream conditions should be checked following the opening of all gates to ensure water levels are within the banks of the channel throughout the subdivision.

Downstream gage water level of 1.80 feet indicates all three culvert gates should be closed.

Upstream gage water level of 2.80 feet indicates all three culvert gates should be closed.

ALPINE WOODS SUBDIVISION
CULVERT GATES AT LEVEE

OPERATIONS MANUAL
SEPTEMBER 2012

Appendix D. Embankment Protection Report

Embankment Protection

New and old levee sections are protected with continuous rip rap armoring. No appreciable erosion is anticipated as the result of a 100 year flood. Internal erosion and instability of the embankment resulting from seepage and piping is not anticipated (See Embankment and Foundation Stability Analysis).

The levees were originally constructed with a continuous buried scour toe except for a section constructed with a self-launching scour toe/apron in 2013. Rip rap armoring was not installed on the landward side of the levees. The east end of the upper levee is tied into higher ground, preventing flooding on the landward side, therefore the absence of backside armoring on that levee should not be an issue. At large flood flows, the gap between the two levees will allow flood waters to enter the gap and flow along the landward side of the downstream levee. The levee was constructed with coarse gravel materials which can provide limited erosion resistance for a short duration. Natural drainage directs water into existing drainage channels and away from the levee. Inspections following the 2006 flood event did not identify erosion problems on either side of the downstream levee.

New Levee Constructed in 2013.

For the Groin 3 riprap design, the project team utilized RIPRAP Design System 3.0 (West Consultants, Inc), a streambank protection design software program. RDS provides guidance in sizing riprap for bank and bottom protection from scour. The software allows the user to select up to 7 riprap design methods. For the Lowe River Groin 3 riprap project, four methods were selected for comparison, including: the US Corps of Engineers (Engineer Manual 1110-2-1601), FHWA HEC-11 (FHWA 1989), US Geological Survey (WRI Report 86-4127), and ASCE Manual 54.

The Groin 3 riprap design was based on a 2008 cross-section survey of the Lowe River and Alpine Subdivision, and results from a HEC-RAS hydraulic analysis of the Lowe River. Flow characteristics at the Groin 3 location were developed with the HEC-RAS model using the design flow. Several flows were analyzed, including the 100-year flood (31,900 cfs), the 500-year flood (40,800 cfs), and others. The selected design flow was 48,650 cfs, which was the estimated Lowe River discharge in the vicinity of the Alpine Subdivision during the October 2006 flood event. For the analysis, the largest average channel velocity and greatest depth for the 12 model cross-sections that encompass the new levee section (Cross-sections 6.9 to 8.4) were used.

Input parameters for the riprap analysis included the design flood (48,650 cfs), average channel velocity (6.3 ft/sec) local flow depth 4.9 ft) , unit weight of stone (165 lb/ft^3), side slope (3H:1V, and safety factor (1.2). The safety factor value should reflect the uncertainties in estimates of the velocity, unit weight of stone and depth. The minimum allowable value is 1.0. The minimum recommended value is 1.1. In addition, the safety factor should be increased when the following situations arise: imposed impact (logs, trees, vessels, ice, debris), vandalism or theft of rock, quality control problems with the rock, freeze-thaw cycles and expanding flow (increased turbulence). A minimum safety factor of 1.25 should be used at abrupt changes in roughness (e.g., riprap to natural channel or concrete). The selected value was 1.2. However, at a shallow embankment slope of 3H:1V, the safety factor does not affect the outcome of calculations for three of the four methods. Only the results from the USACE method are increased. Therefore, as the selected shallow riprap slope of 3:1 is much more stable than steeper slopes, increasing the safety factor would not alter the results for this riprap analysis.

Results from the 4 different methods are found in Table 1.

Table 1. Riprap calculations.

METHOD	**USACE**	
Minimum D30	0.37 ft	
Minimum D90	0.53 ft	
Layer Thickness	0.75 ft	
Percent Lighter By Weight	**Minimum**	**Maximum**
W100	15 lb	36 lb
W50	7 lb	11 lb
W15	2 lb	5 lb
METHOD	**ASCE**	
Minimum D30	0.37 ft	
Minimum D90	0.53 ft	
Layer Thickness	0.75 ft	
Percent Lighter By Weight	Minimum	Maximum
W100	15 lb	36 lb
W50	7 lb	11 lb
W15	2 lb	5 lb
METHOD	**USGS**	
Minimum D30	0.85 ft	
Minimum D90	1.23 ft	
Layer Thickness	1.75 ft	
Percent Lighter By Weight	Minimum	Maximum
W100	185 lb	463 lb
W50	93 lb	137 lb

W15	29 lb	69 lb
METHOD	**HEC-11**	
Layer Thickness	1.90 ft	
Percent Smaller by Size	Rock Size (ft)	Rock Size (lb)
D_{100}	1.3	200
D_{50}	0.95	75
D_{10}	0.40	5.0

The new Groin 3 levee section is removed from the immediate active channel, not subject to annual flows, and is not subject to deep or fast flows if and when a flood does occur. Based on its off-channel location and the results of the riprap calculations, the State of Alaska Class II riprap gradation was selected for the Groin 3 levee.

Table 2. State of Alaska Class II riprap gradation.

Percent	Rock Size (lb)
50-100%	200 lb or more
0-15%	up to 25 lb
0-10%	more than 400 lb

For repairs to the existing levees that are located along the main channel, Class III riprap was specified.

Riprap Thickness on Slope

The minimum thickness of the riprap on the slope should be equal to the upper limit D_{100} stone diameter. All of the stones are to be contained reasonably well within the riprap layer. The thickness, at any point, is the perpendicular distance to a surface enveloping the maximum height of the stone above the sloped embankment surface.

Granular Filter for Riprap Layer

The filter is a transitional layer to prevent the migration of the fine soil particles through the riprap structure, and permit relief of hydrostatic pressures within the soils. If openings in the filter are too large, excessive flow piping through the filter can cause erosion and failure of the bank material below the filter.

For rock riprap, the design method involves determining the filter ratio, which is defined as the ratio of the D_{15} of the coarser layer to the D85 of the finer layer.

$$\frac{D_{15}\text{ (coarse layer)}}{D_{85}\text{ (finer layer)}} < 5 < \frac{D_{15}\text{ (coarse layer)}}{D_{15}\text{ (finer layer)}}$$

Gradation test results from embankment soils indicate the D_{85} of the embankment soils (finer layer) is 3" (76.2 mm). If the D_{15} of the riprap layer (coarser soils) is less than 15", the filter ratio is met. Table 2 indicates a gradation class of 0-15% should weigh up to 25 lb.

Based on an analysis of Class II riprap material and protected soil gradation, we determined that the riprap acceptably meets filter criteria for protection against erosion. As such, no additional granular filter was required for Groin 3. See project worknotes.

Scour Calculations

Undermining of toe protection is one of the primary mechanisms of revetment failure. Estimates of depth of scour are needed so that a protection layer is placed low enough in the streambed to prevent undermining.

Several methods are available for calculating scour. Neill's approach (1973) was developed for alluvial rivers, and can be adjusted for bed material ranging from sand to coarse gravel. The method includes several components of scour, including general scour, bend scour, and thalweg formation. An additional factor adjusts the calculation for a straight or mild bend reach.

The modified Lacey equation (1930) is a regime general scour equation, and includes bend scour and thalweg formation. Blodgett's relationship (1986) utilizes bed material gradation to predict scour depth.

Flow characteristics at the Groin 3 location were developed with the HEC-RAS model using the design flow. Several flows were analyzed, including the 100-year flood (31,900 cfs), the 500-year flood (40,800 cfs), and others. The selected design discharge was 48,650 cfs, which was the estimated Lowe River discharge in the vicinity of the

Alpine Subdivision during the October 2006 flood event. For the analysis, hydraulic characteristics were average from the 12 model cross-sections that encompass the new levee section (Cross-sections 6.9 to 8.4).

Input parameters for the riprap analysis included the design discharge, design top width, mean depth, design average velocity, median grain size, and others. Results from the three methods were calculated and averaged to provide an estimated depth of scour. The scour depth is determined from the bottom of the streambed.

Table 3. Scour depth calculations.

Method and Calculated Scour Depth (ft)			Average Scour Depth (ft)
Neill's	Lacey	Blodgett's Relationship	
4.52	2.51	7.57	4.61

The recommended scour depth for installation of the protective riprap toe is 5.0 ft.

The slope is excavated and covered with rock riprap to below expected scour levels. This method is the most permanent, but was impractical in several areas of the new Groin 3 installation. In lieu of excavating the channel bed to the scour depth, a riprap launch apron was incorporated at the base of the riprap blanket. A rock-filled toe trench or toe berm was constructed at the foot of the slope. Often referred to as a "launching apron, " it was laid horizontally on the bed at the foot of the revetment with a height of about 2.5 times the revetment thickness. The intention is that when scour occurs, the apron will settle and cover the side of the scour hole on a natural slope. See project worknotes.

Embankment Material

Class II Rip Rap

Class II Rip Rap

Calculations determined a scour toe elevation should be 5 feet lower than the adjacent channel thalweg. The Class II rip rap was buried to a depth of 8 feet during construction from Station 100+00 (beginning of project) to Station 122+15. A self-launching riprap toe was installed between Station 122+15 to Station 127+87 (end of project) due to the presence of a pond at the base of the levee.

Trenching for Buried Scour Toe

Buried Scour Toe & Trench

Completed Section (Scour Toe Buried)

Finished Levee Section

Self Launching Scour Toe

Older Levee Sections. Older levee sections were constructed between 1985 and 1995. As-built drawings show the dike sections were built with a 3H:1V slope, protected with Class III rip rap armoring, and a 5 foot deep continuous buried scour toe. Table 4 provides State of Alaska Class III riprap gradation.

Table 4. State of Alaska Class III riprap gradation.

Percent	Rock Size (lb)
50-100%	700 lb or more
0-15%	up to 25 lb
0-10%	more than 1400 lb

Note that D_{15} for Class II and Class III rip rap are the same. As with Class II rip rap calculations for the new levee constructed in 2013, the Class III rip rap meets the requirements of the Terzaghi filter equation, which demonstrates the d15 of the filter is not too small (permeability), and not too large (retention):

$$\frac{D_{15}\text{ (coarse layer)}}{D_{85}\text{ (finer layer)}} < 5 < \frac{D_{15}\text{ (coarse layer)}}{D_{15}\text{ (finer layer)}}$$

But in HEC-11 and other reports, there is a second part of that equation to the right:

$$\frac{D_{15}\text{ (coarse layer)}}{D_{15}\text{(finer layer)}} < 40$$

That portion of the equation provides a check of stability through uniformity. The Class III riprap does not quite meet that specification, but the original riprap has held up well for 25 -30 years, likely due to the stability provided by the 3:1 slope.

Overall, the levees appear to be in good condition with no signs of settlement, cracking, seepage, displacement, or erosion. Wind, wave action, ice loading, and impact of debris are not considered threats to the older levee sections. Scour is considered a threat along an exposed outside bend of the upstream levee. In 2013 it was discovered that scour had removed a significant portion of the Class III rock near the outside bend of the upper levee at Station 135+00. A repair project in 2014 replaced 400 linear feet of Class III rip rap, including installation of a 12" Class I filter layer, and installation of a 5 foot deep continuous buried scour toe.

Station 145+00 Looking East

Station 140+00 Looking East

Western Most Dike Section "Groin 2" (Looking Northwest)

2014 Rip Rap Repair

Flood Duration. Estimates of high-magnitude low-probability flood duration are generally based on long-term stream gaging data. However, a flood duration estimate cannot be estimated from stream gaging data for the Lowe River. Though daily discharge data is available from 8/1/1971 to 9/30/1976, the maximum discharge during that period did not exceed the estimated 2-year flood magnitude. No gages were operating on the Lowe River during the October 2006 flood, and a USGS Lowe River recording stage gage was not operational during the September 2012 high water event. The USGS estimated that the October 9, 2006 had a recurrence interval greater than 500 years.

Other long-term data sources were utilized to estimate flood flow duration. Solomon Gulch is a small gaged watershed (USGS 15226000) that empties in the Valdez Arm near the mouth of the Lowe River. Large precipitation events in September and October are responsible for flooding in both watersheds; as such, the Solomon Gulch hydrographs may be used as an indicator of stream flow behavior in the Lowe River. For the period of time encompassing the October 9, 2006 flood, the gage data shows 2 flood hydrographs, including a 2-day event and a 7-day event, including the rising and recession limbs. For the period of time encompassing the September 2012 flood (unknown recurrence interval), the gage data shows an 11-day flood hydrograph, including the rising and recession limbs. Though the recurrence interval of the flood is unknown, September 2012 set a record for the wettest month on record in Valdez (26.2 inches of rain).

Based on these data sources, we estimate that the duration of the base flood in the vicinity of the project area is approximately 7 days (168 hours). During the base flood, average channel velocities along the levees within the project area are estimated to range from 4.4 to 8.1 ft./sec.