



## MEMORANDUM

DATE: June 9, 2014

TO: Brian Landau, PE, LEG, City of Shoreline

FROM: Lolly Kunkler, P.E.  
Patty Buchanan, P.E.

RE: 10th Ave NE from NE 165th St. to NE 175th St.  
Roadway Drainage Review  
Shoreline On-call Services  
SvR Project No. 13044.10

The City of Shoreline has requested that SvR Design review the existing drainage infrastructure and stormwater flow paths along 10th Ave NE from NE 165th St. to NE 175th St. identify drainage system problems, and propose solutions for any identified drainage problems. Attachment A "10th Avenue NE Drainage Profile" summarizes the findings of this memorandum including profiles of the existing drainage system, a list of existing or potential drainage concerns and field observations taken during a February 13th, 2014 site visit.

### Background\*

The flooding and related drainage issues on 10th Ave NE were identified in the City of Shoreline Thornton Creek Watershed Plan (2009). The lack of conveyance capacity on the east side of 10th Ave NE near NE 174th St. caused drainage pipes connected from the east side of the street to backwater and overtop driveways into a few residential properties. The basin plan recommendations to reduce the flood risk included cost prohibitive (\$1-\$3 Million) projects for the City. The City is seeking a more cost effective approach to reduce flood risk and improve drainage along 10th Ave NE.

\*Background information and text was provided by City of Shoreline.

### Project Area

10th Ave NE is a roughly 30ft-wide asphalt roadway that runs north/south within an 80ft-wide right-of-way. Properties on both sides of the road are primarily single family residences, with a Ridgeway Elementary School located at the south west edge of the study area at the intersection with NE 165th St. The residential properties on the east side of the roadway are, in general, at a lower elevation than those on the west side.



Figure 1: Vicinity Map Project Area (NTS)

### Paving

The roadway is crowned along the centerline and slopes longitudinally from north to south with a change in elevation of 414.5+/- at NE 175th St. down to 403.5+/- at NE 165th St. A concrete curb with asphalt sidewalk runs the entire length of the roadway along the east side of the street from NE 175th St. southward toward NE 165th St until the school property where it becomes cement concrete. There is a short segment of curb and sidewalk along the west side of the street beginning approximately 260ft north of NE 171st Pl extending southward to the intersection at NE 171st Pl. where a housing development installed frontage (see Photo 1). At the intersection of NE 170th there is a traffic circle. In general, the roadway pavement appears to be in fair condition with utility patches at locations where new underground utility infrastructure was installed and some patched cracks.

### Drainage

Along the west side of the street between NE 175th St. southward to NE 171st Pl. there is a series of storm drain catch basins which convey water southward in storm drain pipes (ranging in size from 12in-18in). Inflows from pipes at private properties, and from the catch basins along the east side of the street discharge into this conveyance system at the catch basin connections. From NE 171st Pl. southward to NE 165th St., open channels and culverts convey stormwater southward along the west side of the street. Along the east side of the street, between NE 171st Pl to approximately 600ft north of the NE 165th St intersection, flows from the catch basins at the east side of the street are piped westward beneath the roadway and discharged into the open channel at the west side of the street. At the point approximately 600ft north of the NE 165th St intersection, the catch basins at the east side of the street no



longer discharges to the west side of the street but are instead conveyed through 12in storm drain lines which direct flows to the 18in storm drain main within NE 165th St., (see Attachment A). The drainage open channels and conveyance pipes along the west side of the street also discharge into the main within NE 165th St.



**Photo 1:** Sidewalk along the frontage of a development at the west side of 10th Ave. NE. (February 13, 2014)

In general, the open channel and culvert system along the west side of the street appears to be in adequate condition (note: inspection of pipe interior was not part of investigation scope and was not conducted). The culvert pipes show little sign of degradation or breakage at the mouth, however the open channels themselves have significant amounts of leaf and litter debris, shrub overgrowth, and standing water (see Photo 2).





**Photo 2:** Standing water within open conveyance along the west side of 10th Ave. NE just south of NE 170th St. (February 13, 2014)

Survey information indicates that the pipe and open channel conveyance has little slope in the direction of flow (from north to south) ranging from 0.5% to 1.5% and in some cases both pipes and conveyance channels are back sloped from south to north. Along the west side of the street no evidence that stormwater flows from the culvert and open channels have passed onto private property, such as sediment deposits from flow paths or sandbags, was observed. It is possible that nuisance ponding could occur at driveway entrances or within conveyance swale during prolonged storm events.

At the east side of the street there is evidence of previous gutter line flows entering onto private property, with one residence (lot #1270) barring flows at their driveway with sandbags (see Photo 3). Additionally a new rolled curb further north in front of lot#1292 indicates attempts to capture flows within the boundaries of the gutter line.



**Photo 3:** Residence #17030 10th Ave NE, lot#1270, with sandbags. New asphalt patch shows installation of catch basin at gutter flow line. (February 13, 2014)

### Drainage Mitigation

There are two primary areas of concern related to the storwater conveyance system and stormwater flow paths along 10th Ave NE. The first concern is related to the past and possible future flow of stormwater from the eastern gutter line onto the private properties along the east side of the roadway. Drainage mitigation opportunities along the east side of the roadway include:

- Increasing the maintenance schedule, particularly in the fall when leaf debris is significant. This would reduce risk of structure blockages.
- Performing public outreach identifying to the neighborhood the importance of keeping the gutter line and structures free of debris, such as promoting the City's Adopt-A-Drain program, would encourage community involvement in the maintenance and care of the drainage system.
- Installing asphalt berms downstream of the existing catch basin structures or installing additional drainage structures immediately upstream of the driveway curb cuts would reduce the risk of drainage bypassing collection.
- At catch basins along the east side of the street, where 8-inch pipe outlets are present, install a larger diameter pipe to increase capacity to the downstream conveyance channel.
- The installation of curb bulbs directing flow into raingardens with overflows would provide treatment and reduce the risk of flows bypassing collection.





Significant drainage mitigations include the installation of permeable pavements with an underdrain along the east side of the street or increasing the pavement depth along the east side of the street to change the "crowned" roadway section to a "thrown" roadway section. If geotechnical investigation is performed and it is determined that the soils are infiltrative, the underdrain may not be necessary.

The second area of concern is the standing water within the open channels and culverts along the west side of the street. Drainage mitigation opportunities along the west side of the street include:

- Cleaning leaf debris and litter from the open channel to reduce the risk of clogging the downstream inlets and promote natural infiltration. Increasing the maintenance schedule, particularly in the fall when leaf debris is significant.
- Performing public outreach identifying to the neighborhood the importance of keeping the gutter line and flow channel free of debris, such as promoting the City's Adopt-A-Drain program, would encourage community involvement in the maintenance and care of the drainage system.
- Amending soils within the existing open conveyance channels or remove soils and install a bioretention facility to promote treatment and infiltration.

Significant drainage mitigations include removing the existing open channel and culvert system and replacing it with a piped system that has increased slope.

#### Mitigation Sequencing

Table 1 identifies mitigation strategies at locations along the roadway based on existing conditions and drainage concerns. Drainage mitigations strategies which decrease the possibility of gutter line flow intrusion onto adjacent private properties on the east side of the roadway should be the first employed. Increasing the maintenance of the storm drain facilities along the east side of the street will reduce the risk of overflow at the catch basins and requires no construction. Additionally education, or the Adopt-a-Drain program noted above, would provide a community understanding and possibly community involvement. In conjunction with the increased maintenance and education, the City should consider the design and installation of curbing/berming and/or additional structures along the east side of the roadway to eliminate risk of flooding at the adjacent residences.

Along the west side of the roadway, we recommend that the City increase maintenance frequency to reduce blockages and ponding within the open channels. At the locations identified in Table 1, soil amendment within the open conveyance systems would encourage infiltration of stormwater into the native soils. This mitigation strategy would not limit the future opportunities to regrade and reinstall the conveyance system to provide positive drainage. Geotechnical data collection is recommended to determine the feasibility of infiltration facilities.

If the mitigation strategies do not sufficiently alleviate the drainage problems, we recommend that the City conduct a larger basin-wide study to determine if there are greater capacity issues that need to be addressed. Soils testing would provide data



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needed to determine if infiltration facilities are a possible solution to reduce stormwater volumes and capacity concerns.

As noted above Attachment A "10th Avenue NE Drainage Profile" summarizes the findings of this memorandum including the profile of the existing drainage system, identifies existing or potential drainage concerns, and includes field observations taken during a February 13th site visit. Table 1 summarizes the drainage concerns identified in Attachment A.



Roadway	Station	Offset Side	Drainage Concern	Drainage Mitigation
10th Ave NE	12+35 to 12+50+/-	west	open channel has localized low point preventing proper conveyance and standing water was observed at the location during the site walk.	adjust up and downstream conveyance pipes to increase slope amend subgrade soils to increase infiltration volume - check infiltration rate of native soils to confirm they are suitable for infiltration and perched groundwater is not present. regrade ditch to provide positive slope
10th Ave NE	13+35 to 13+50 +/-	west	open channel has localized low point preventing proper conveyance and standing water was observed at the location during the site walk.	adjust up and downstream conveyance pipes to increase slope amend subgrade soils to increase infiltration volume- check infiltration rate of native soils to confirm they are suitable for infiltration and perched groundwater is not present. regrade ditch to provide positive slope
10th Ave NE	14+95 to 15+60 +/-	west	conveyance pipe has zero slope	adjust conveyance pipe to increase slope
10th Ave NE	15+60 to 16+85 +/-	west	channel is back sloped	adjust conveyance pipes and channel to increase slope
10th Ave NE	17+30 to 17+85 +/-	west	channel and pipe are back sloped	adjust up and downstream conveyance pipes to increase slope amend subgrade soils to increase infiltration volume- check infiltration rate of native soils to confirm they are suitable for infiltration and perched groundwater is not present.
10th Ave NE	19+20 to 19+50+/-	west	open channel has localized low point preventing proper conveyance and standing water was observed at the location during the site walk.	adjust up and downstream conveyance pipes to increase slope amend subgrade soils to increase infiltration volume- check infiltration rate of native soils to confirm they are suitable for infiltration and perched groundwater is not present. regrade ditch to provide positive slope
10th Ave NE	19+90 to 21+15 +/-	west	channel is back sloped	adjust downstream conveyance pipe and channel to increase slope amend subgrade soils to increase infiltration volume- check infiltration rate of native soils to confirm they are suitable for infiltration and perched groundwater is not present.
10th Ave NE	24+90 to 26+10 +/-	west	channel is back sloped conveyance pipe is back sloped	adjust downstream conveyance pipe and channel to increase slope amend subgrade soils to increase infiltration volume- check infiltration rate of native soils to confirm they are suitable for infiltration and perched groundwater is not present.
10th Ave NE	26+25 +/-	east	evidence of gutter flows entering private property	install asphalt berm to direct gutter flows into adjacent catch basin
10th Ave NE	30+10+/-	east	potential for gutter flows to enter private property	install asphalt berm to direct gutter flows into adjacent catch basin
10th Ave NE	34+40+/-	east	ponded water along gutter line	remove asphalt surface and regrade along curb to increase slope and reduce ponding
10th Ave NE	general	west/east	leaf and litter debris in the open conveyance is restricting flows	increasing the maintenance schedule, particularly in the fall, to remove leaf and litter debris keep conveyance pipes, channels and drainage structures clean

**Table 1: Summary of Existing Drainage Observations and Potential Mitigation Strategies.**

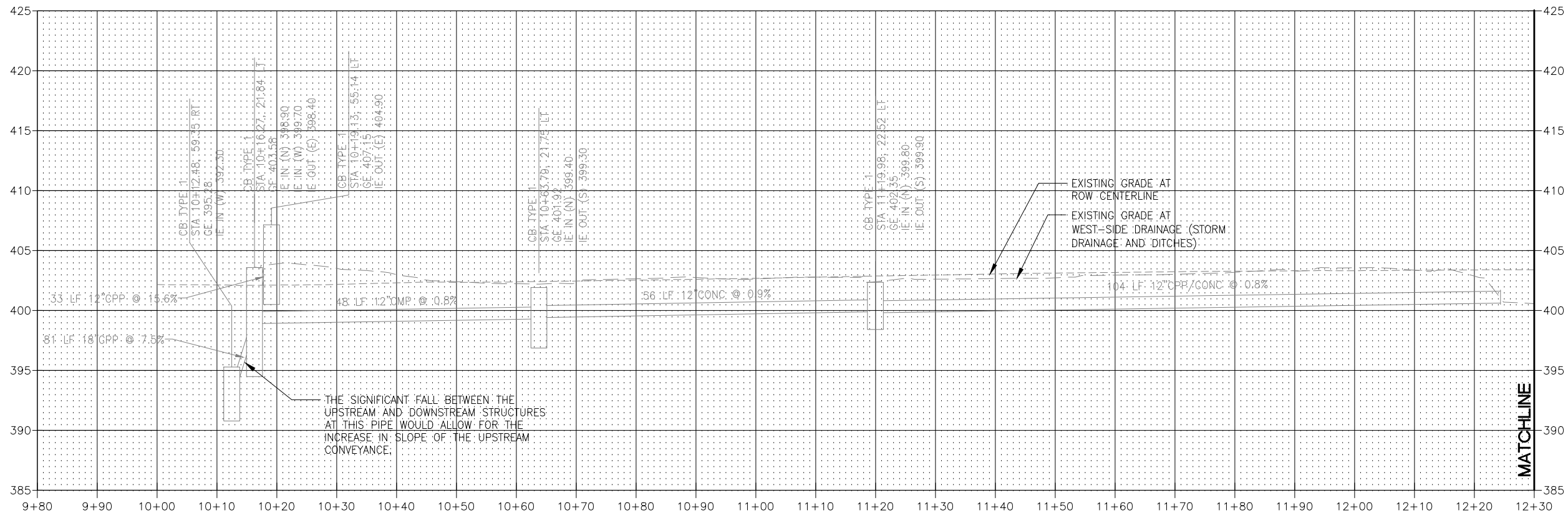
Site observations were made during a site visit on February 13, 2014. According to Weather Underground for Ridgecrest station in Shoreline, WA no precipitation occurred on February 12th and 13th, 2014.



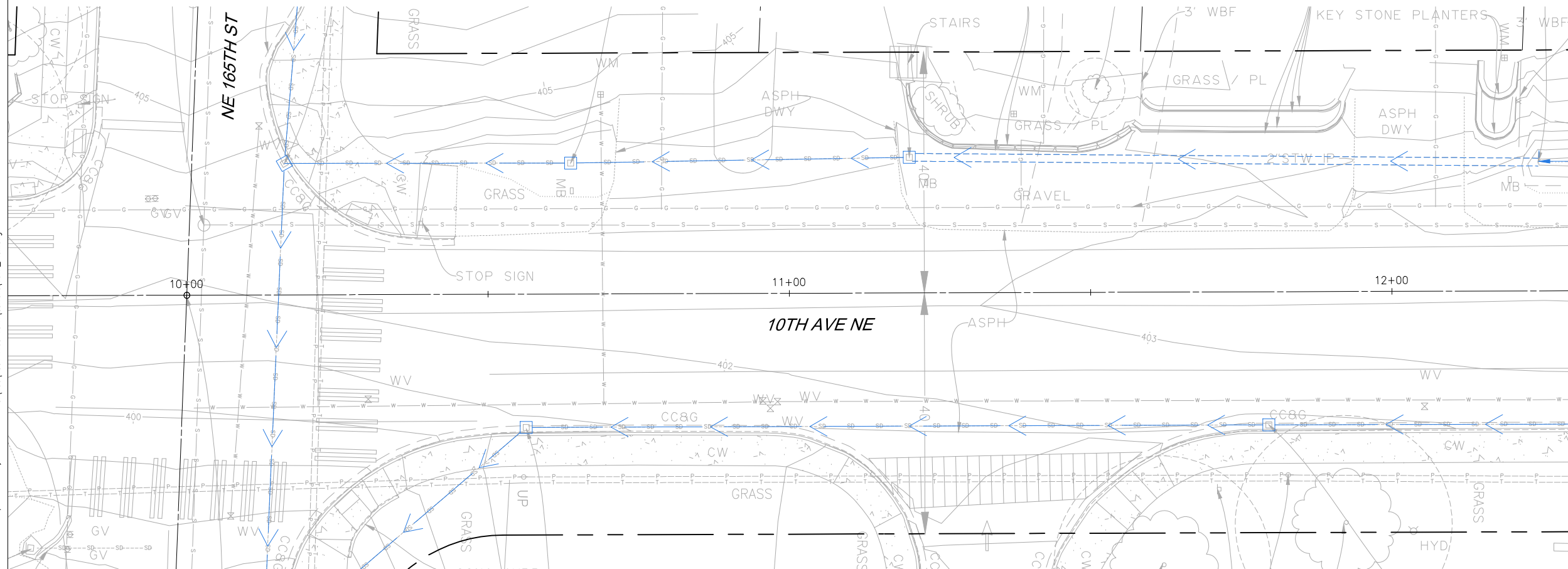
ATTACHMENT A

**10TH AVENUE NE DRAINAGE PROFILE**

W/ IDENTIFIED PROBLEMS AND POTENTIAL SOLUTIONS

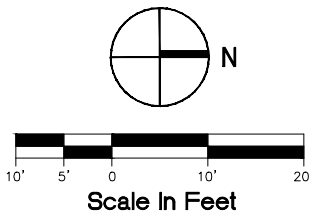


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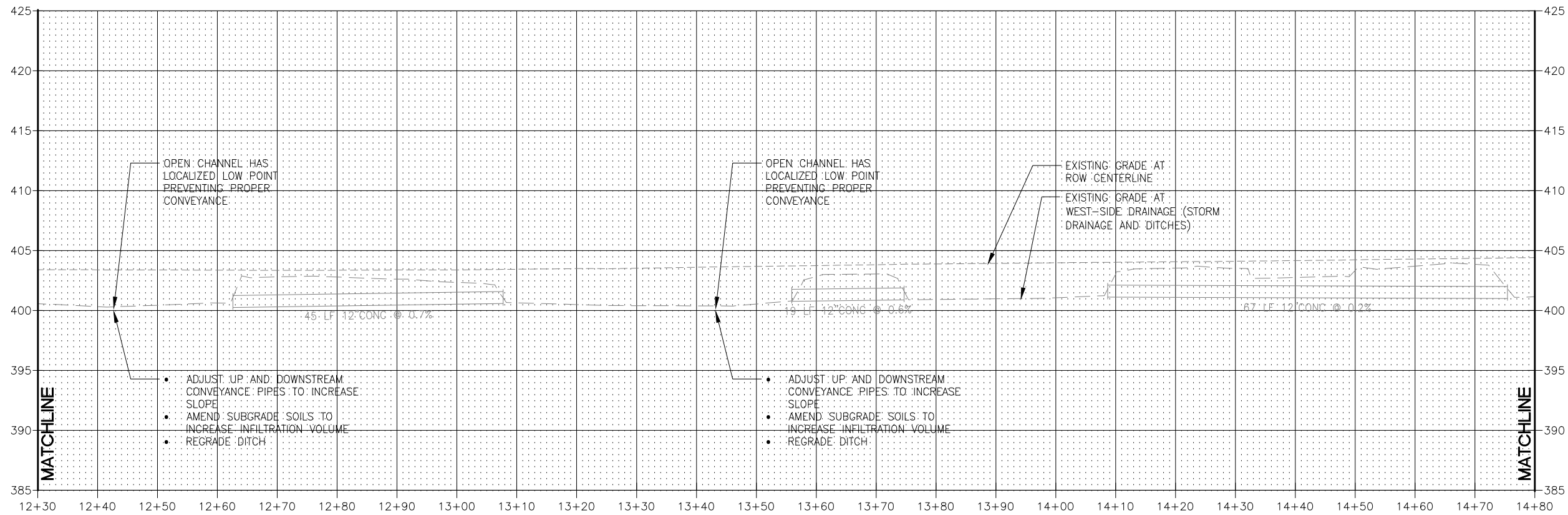
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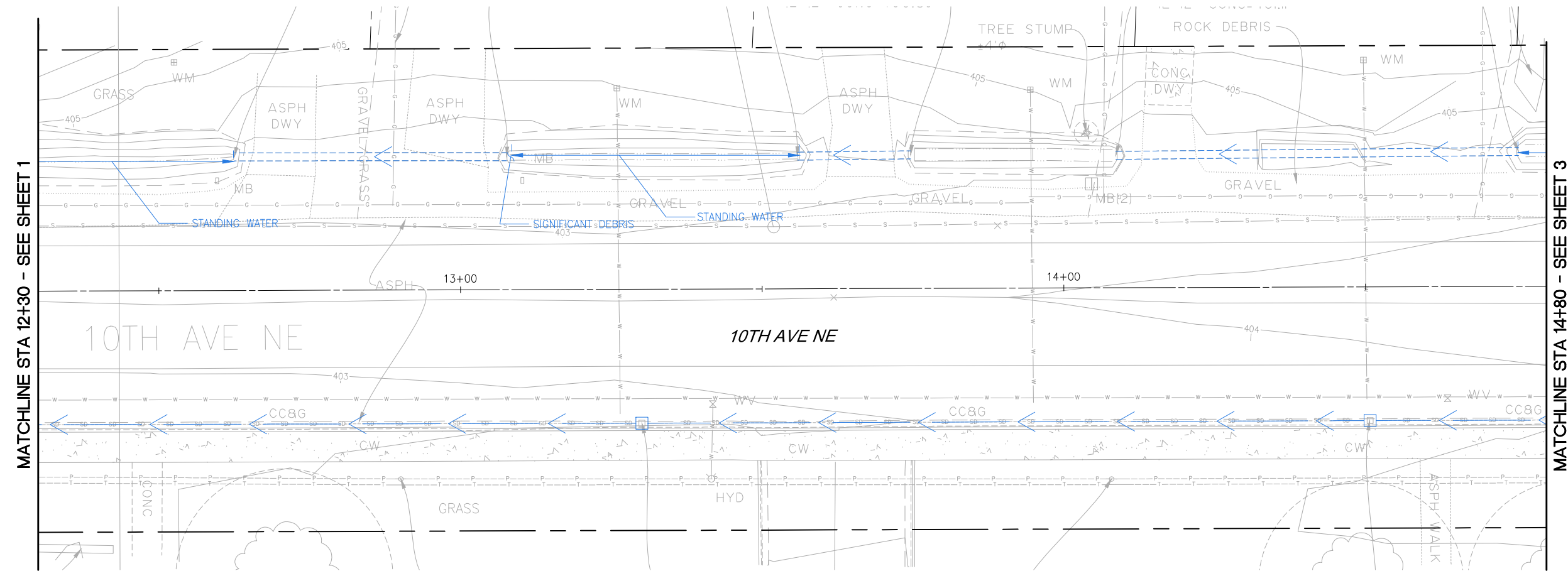
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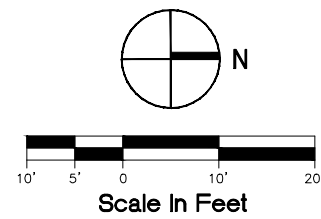
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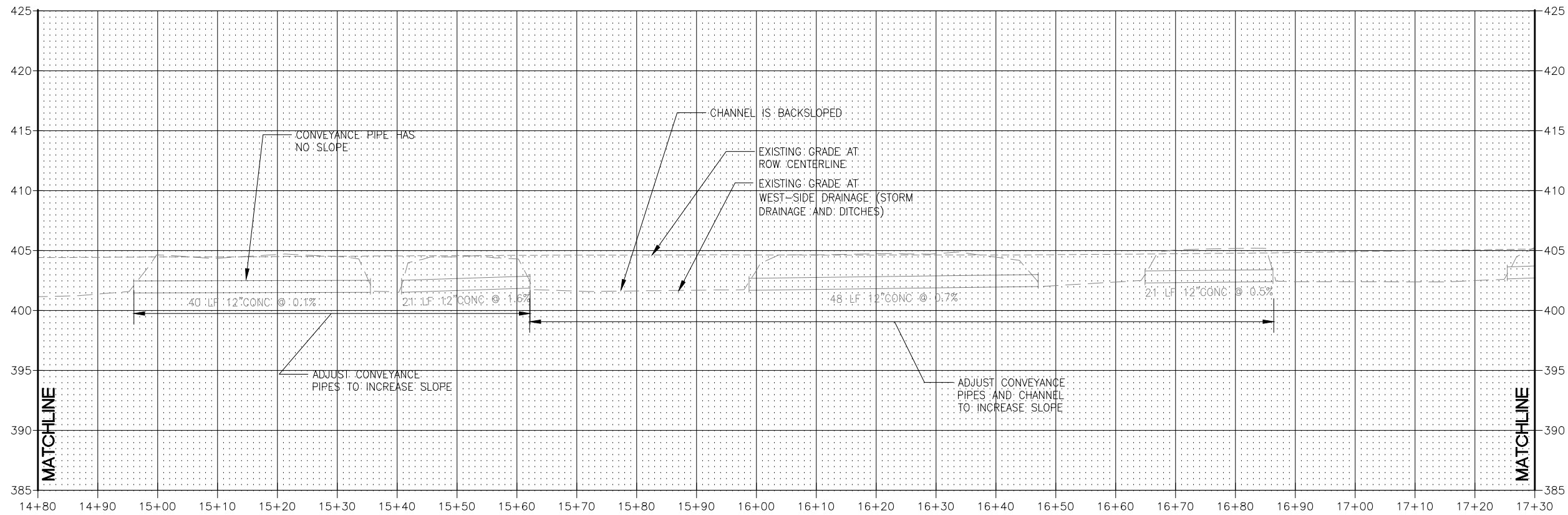
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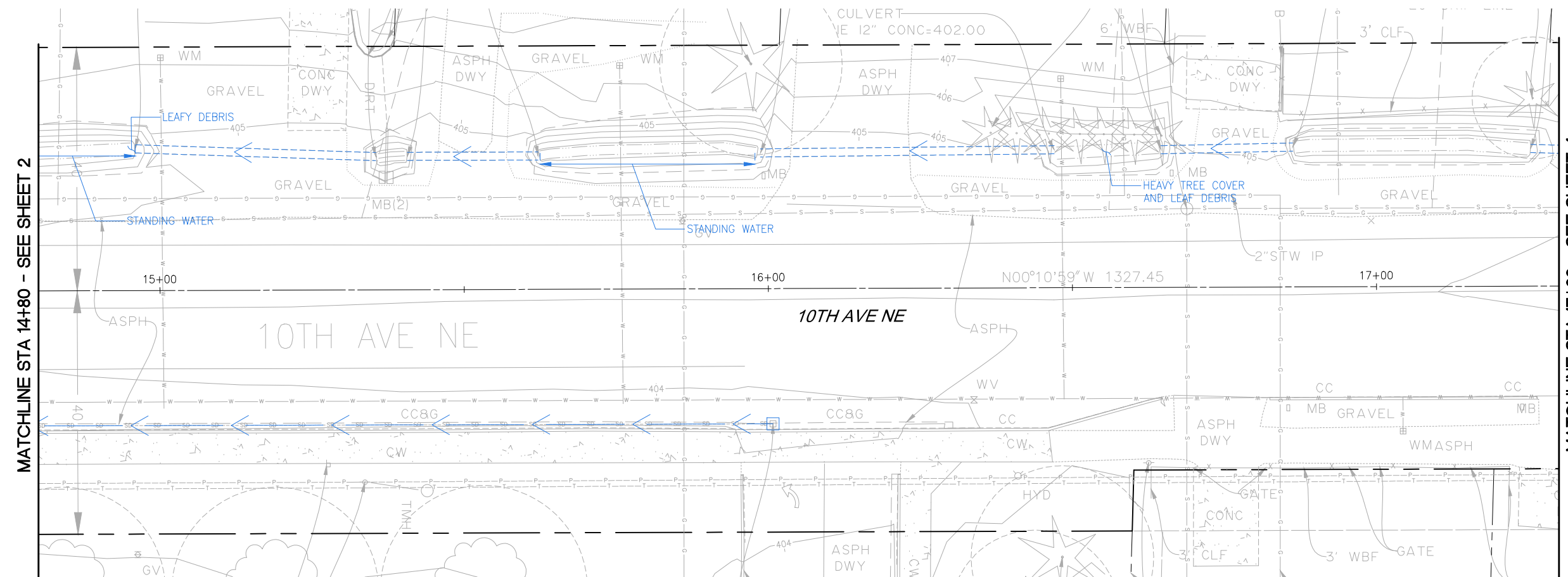
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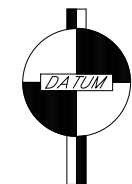
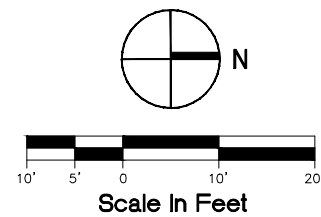
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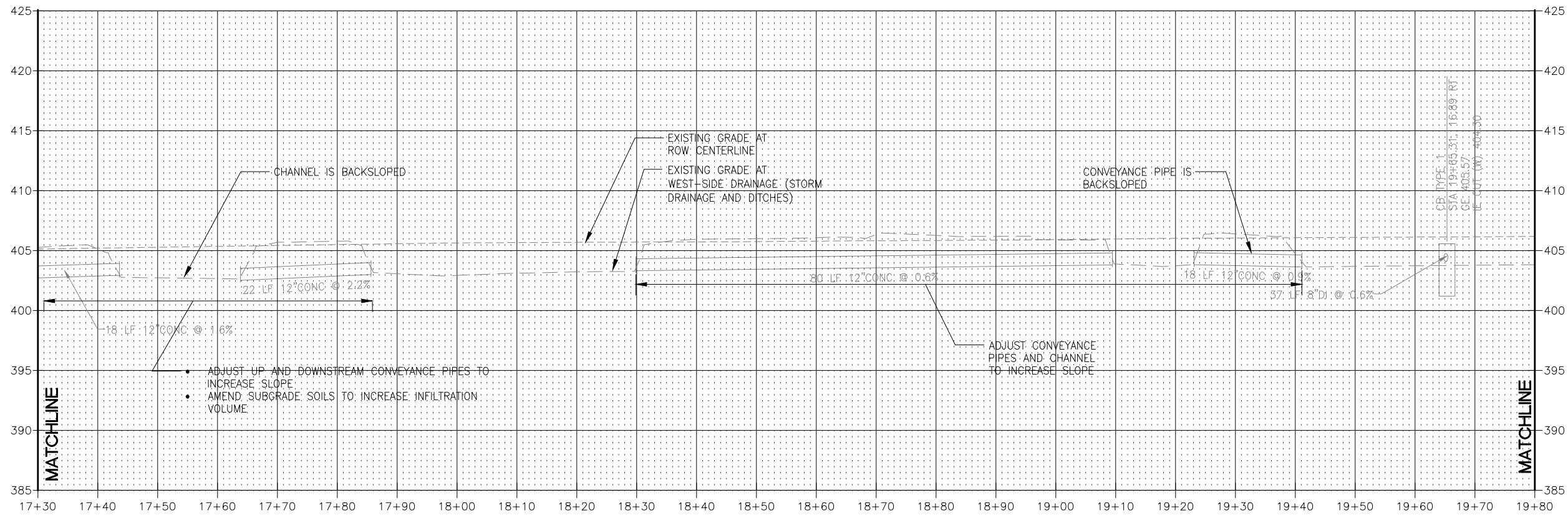
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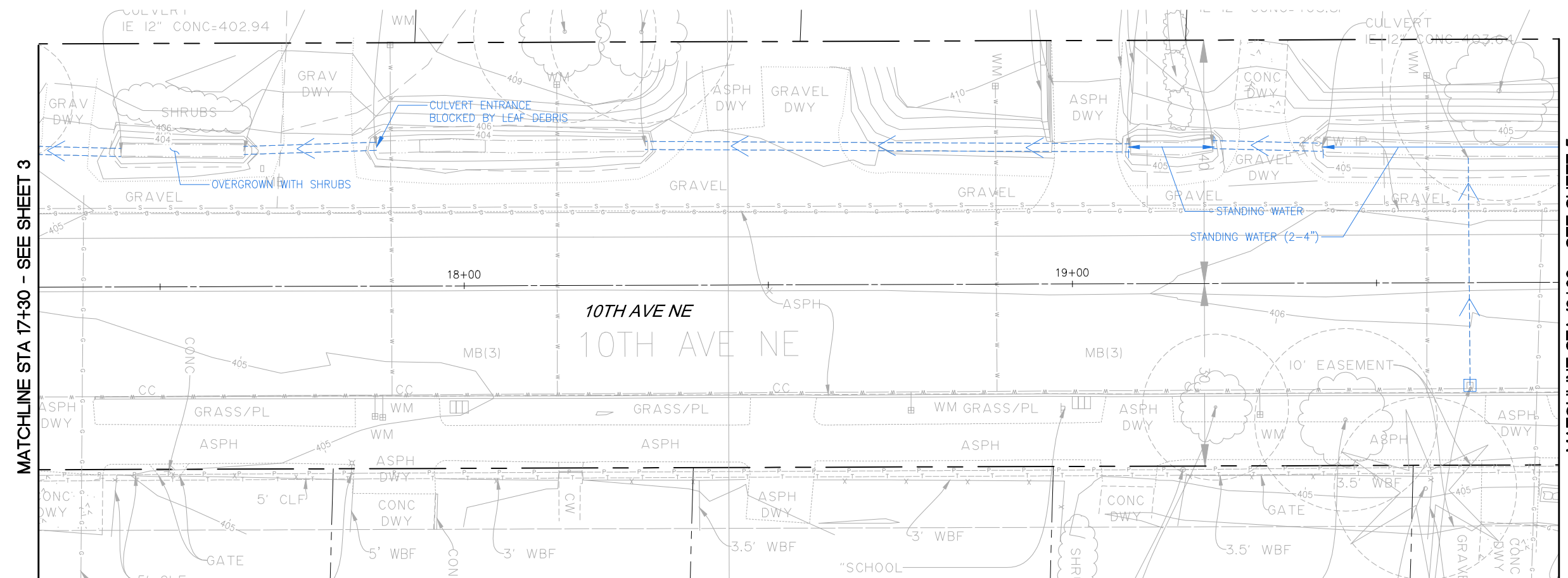
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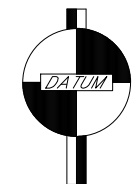
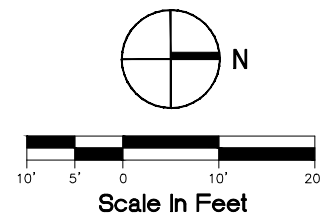




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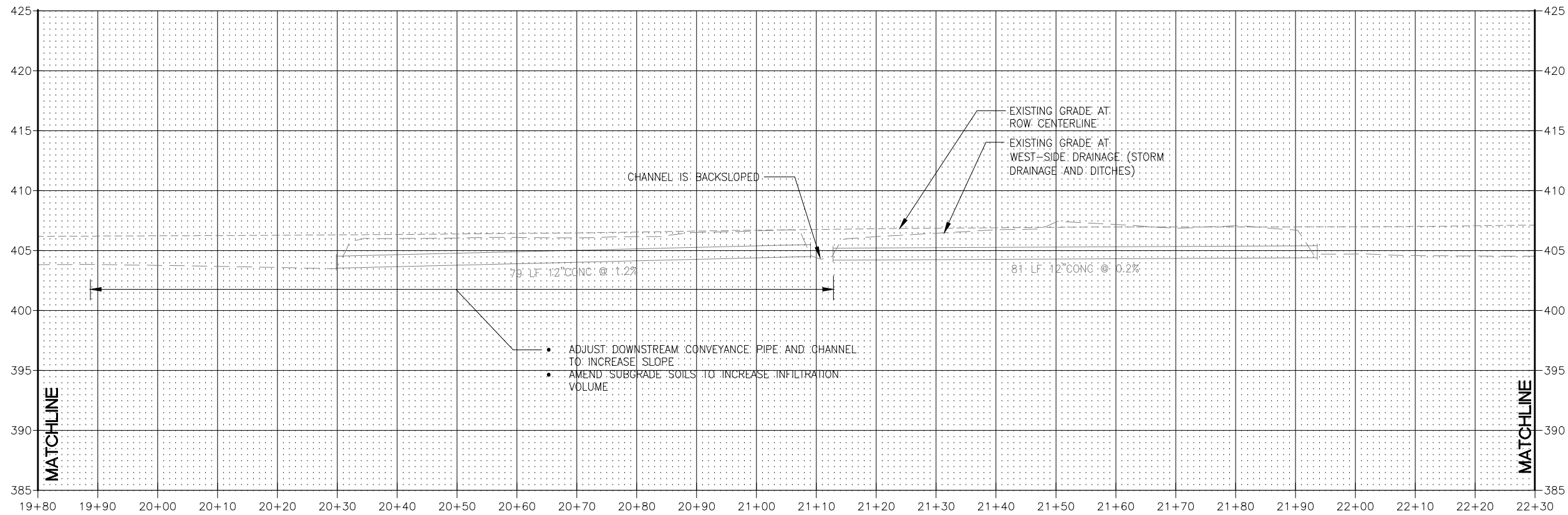
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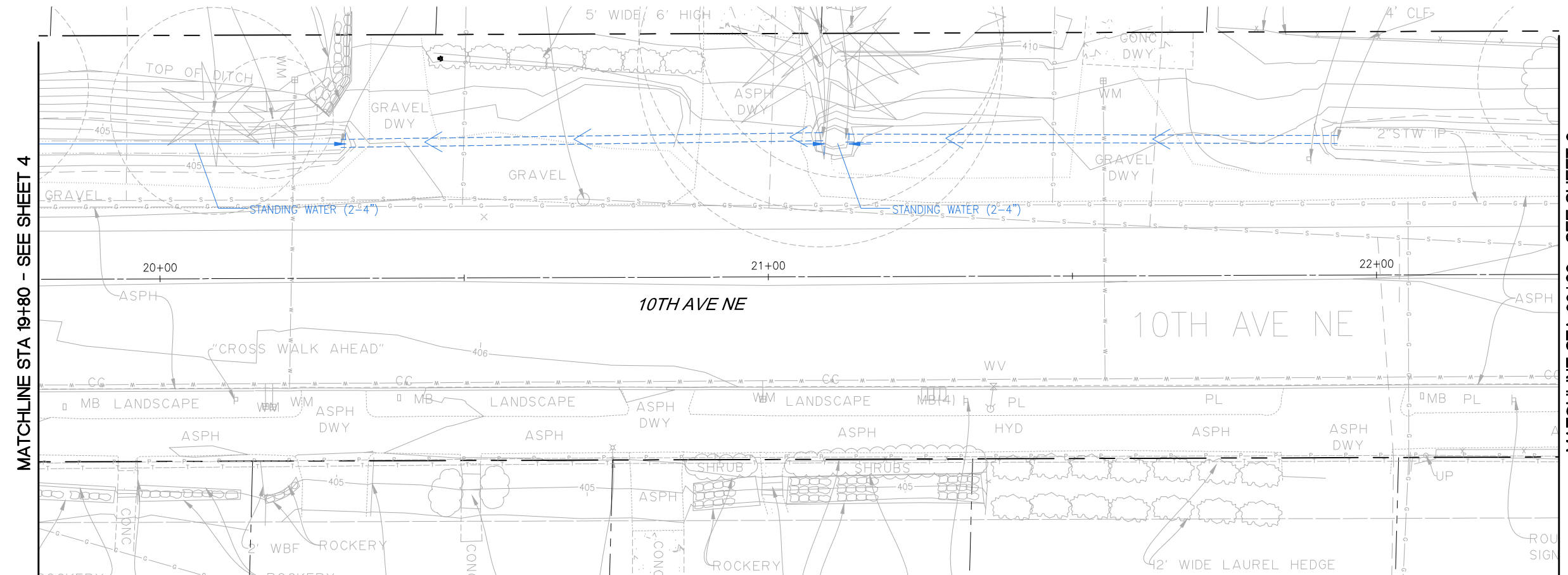
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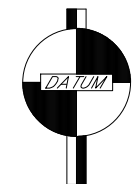
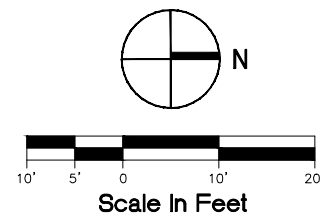
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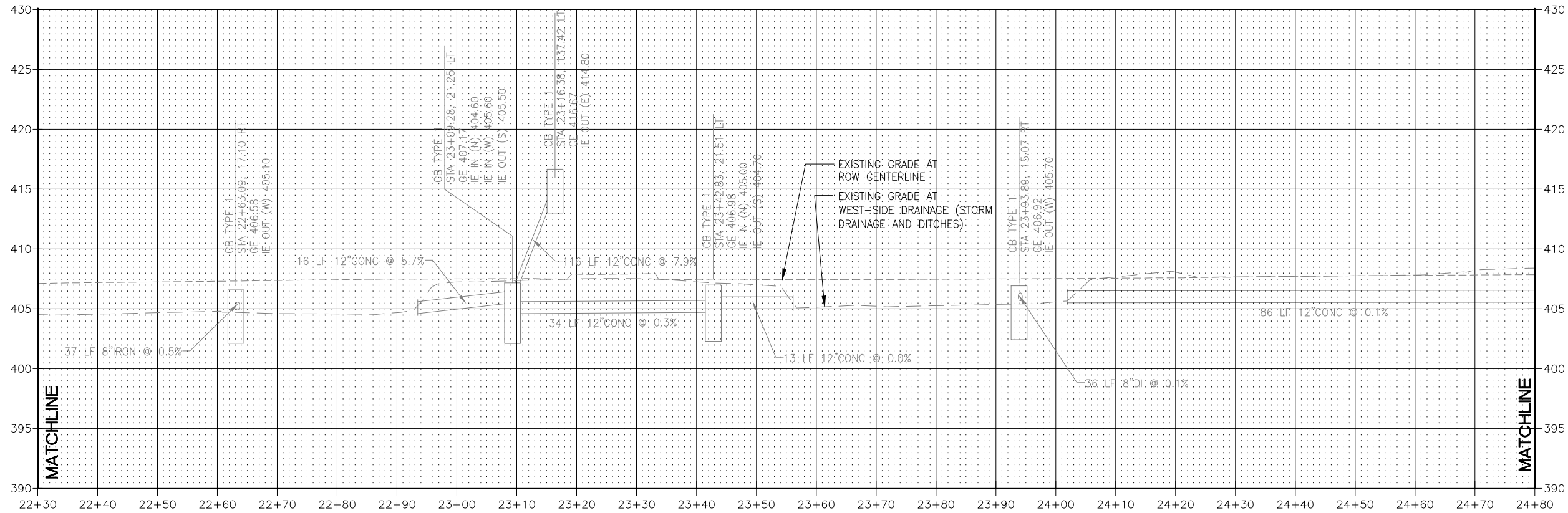
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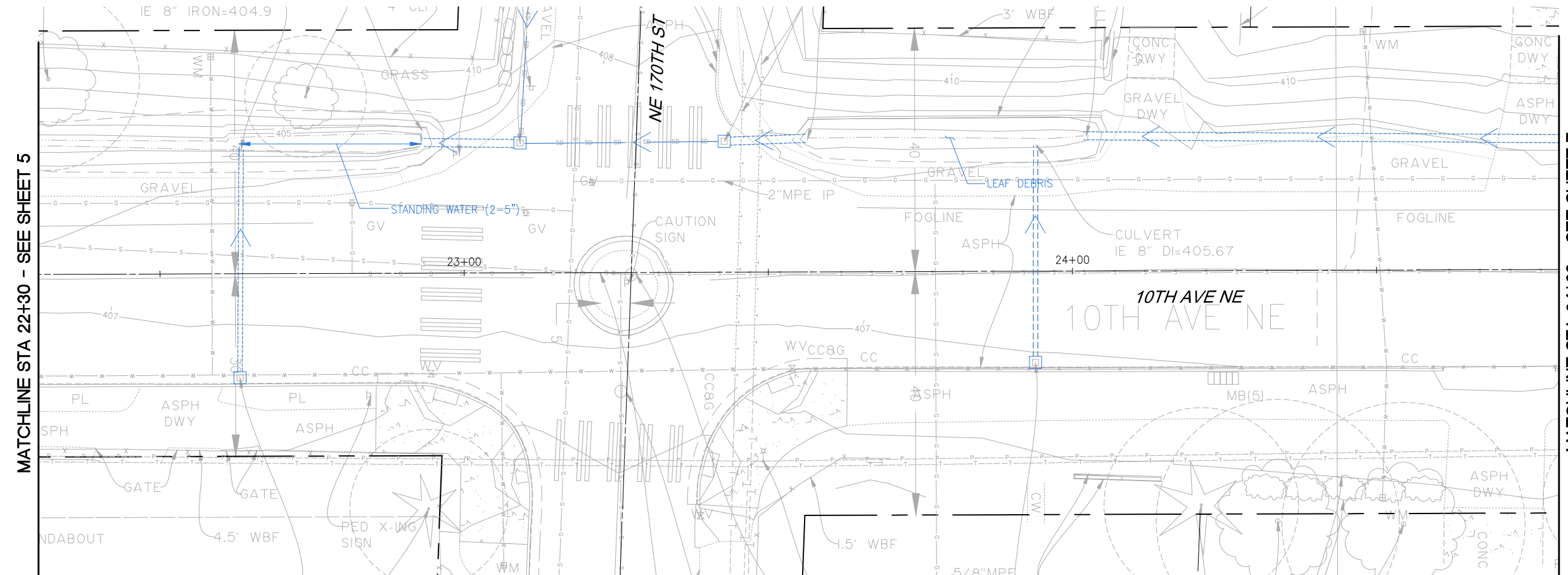
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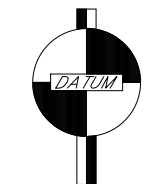
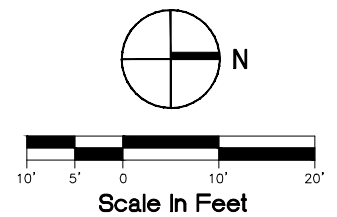
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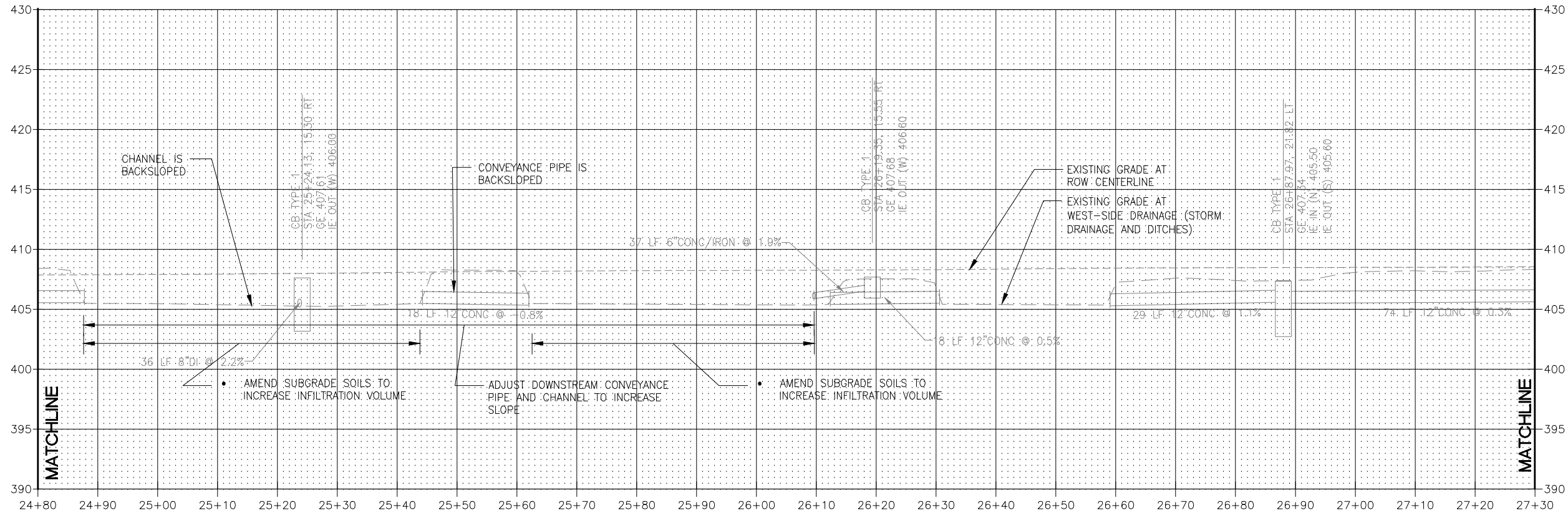
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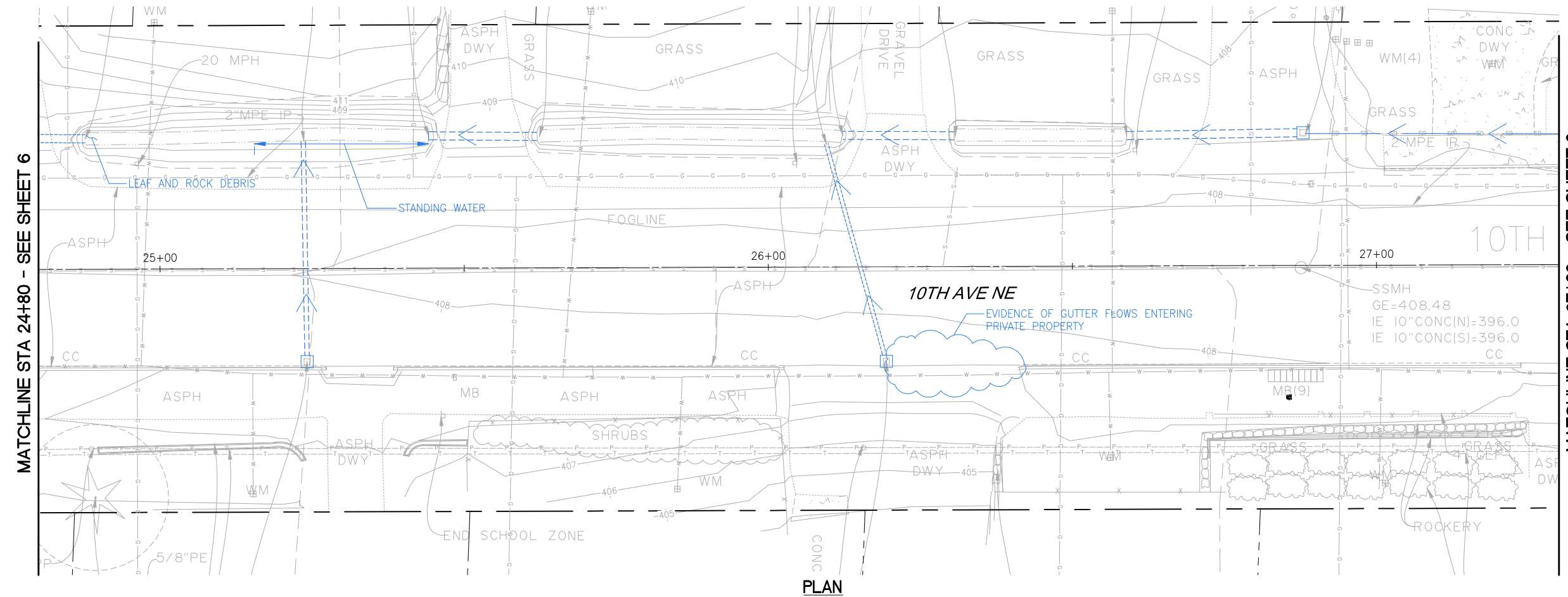
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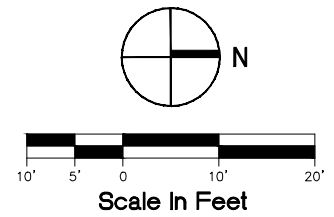
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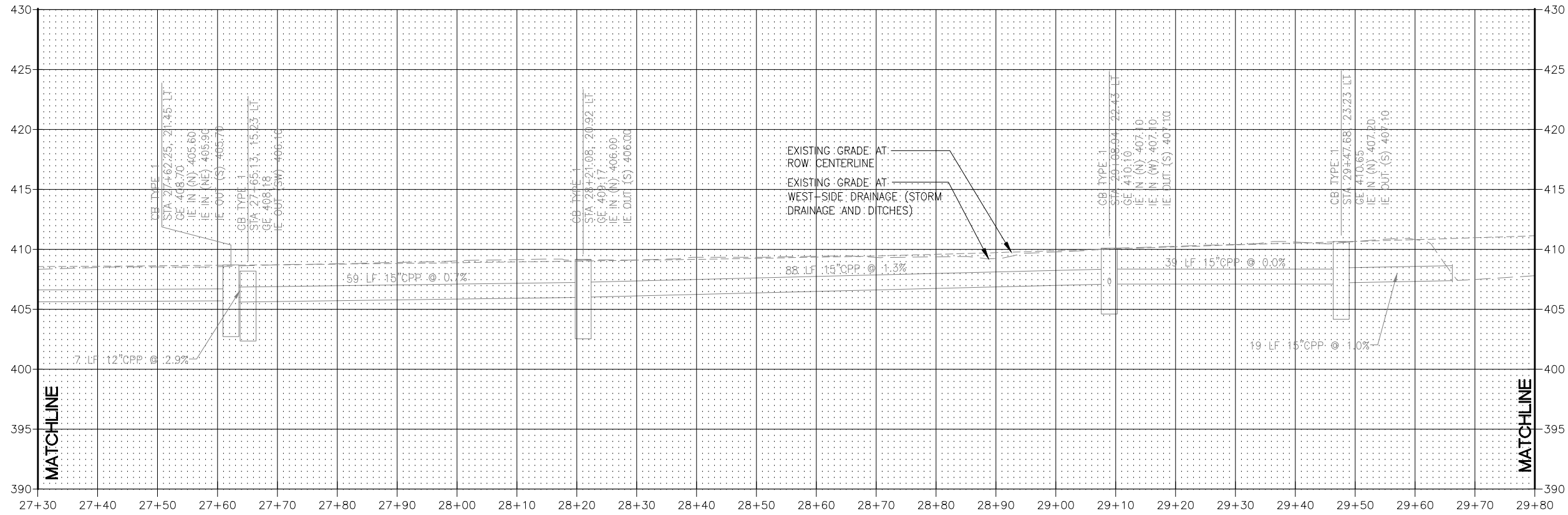
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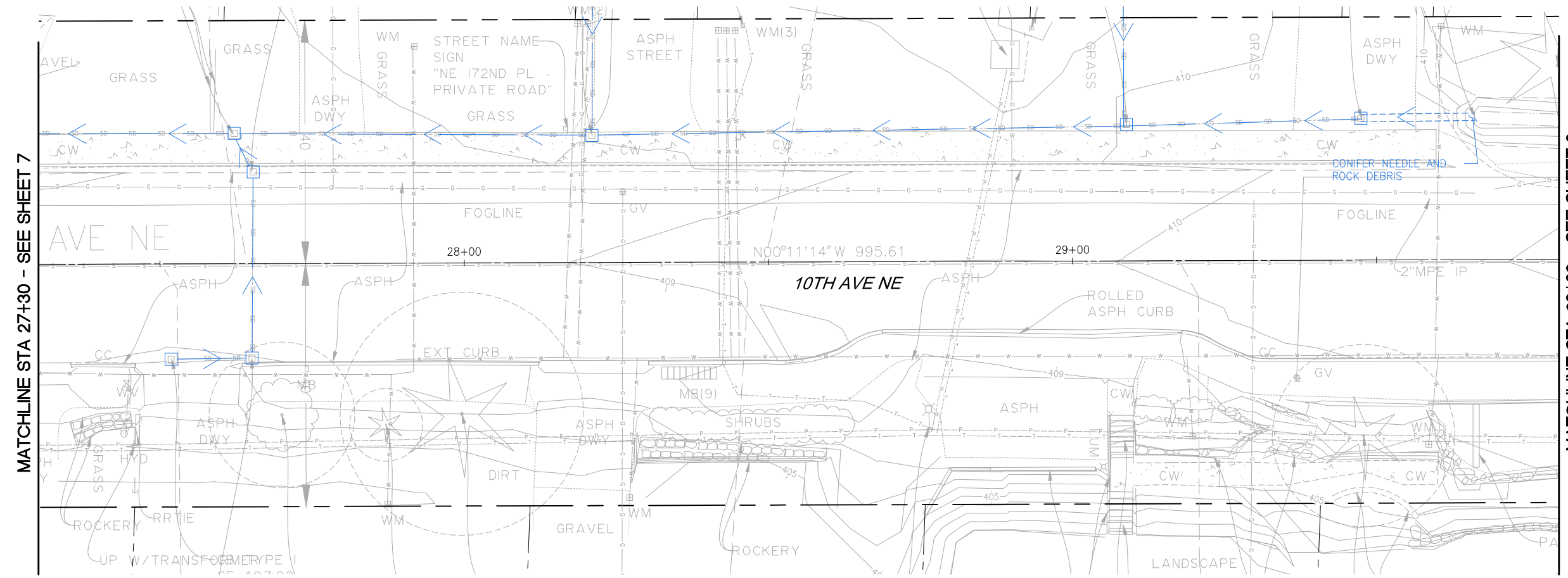
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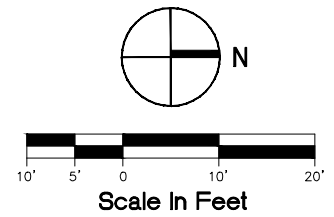




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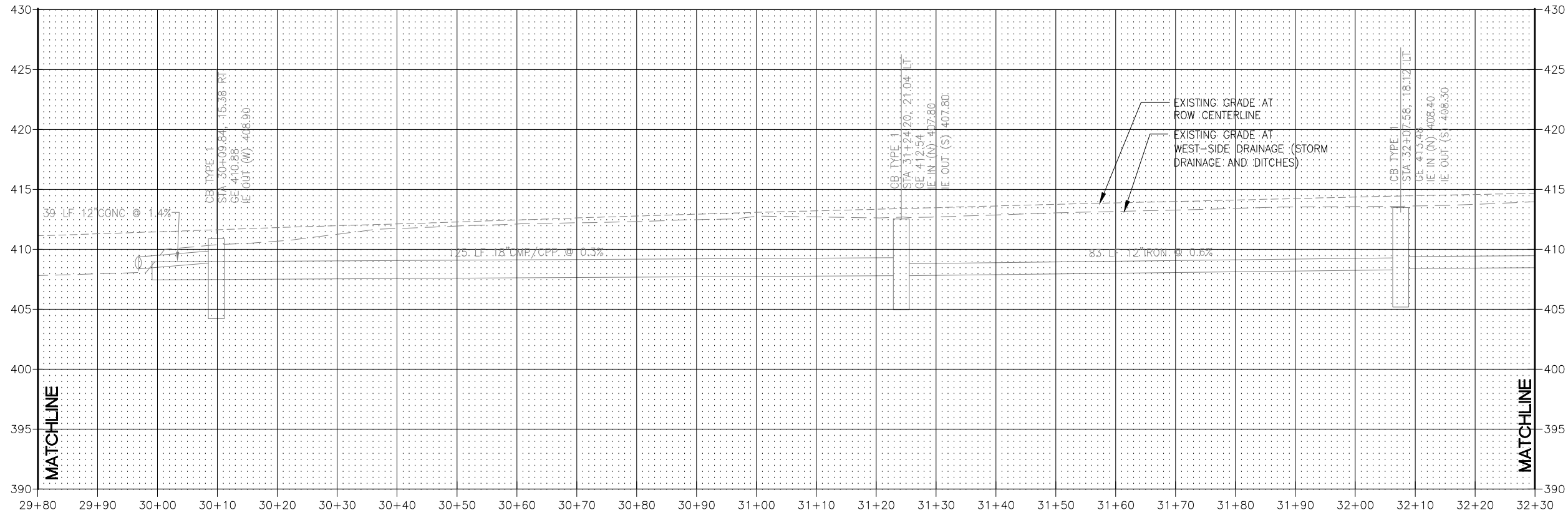
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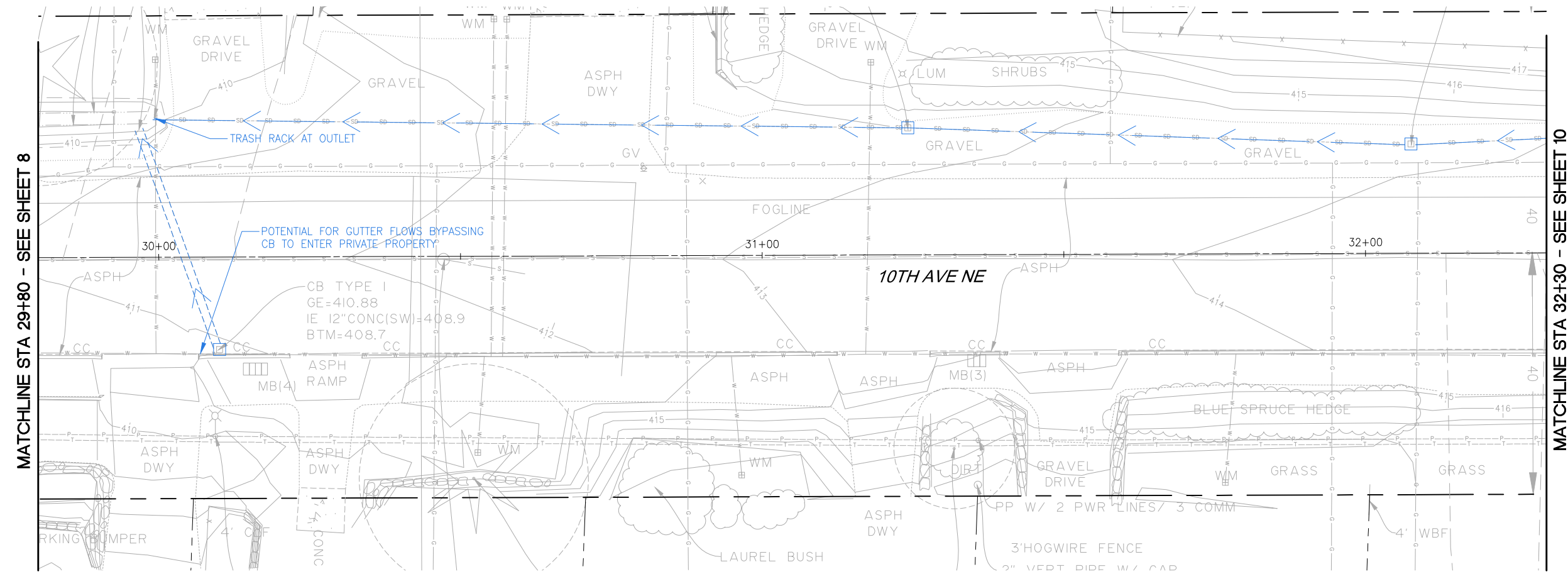
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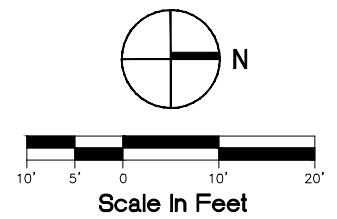
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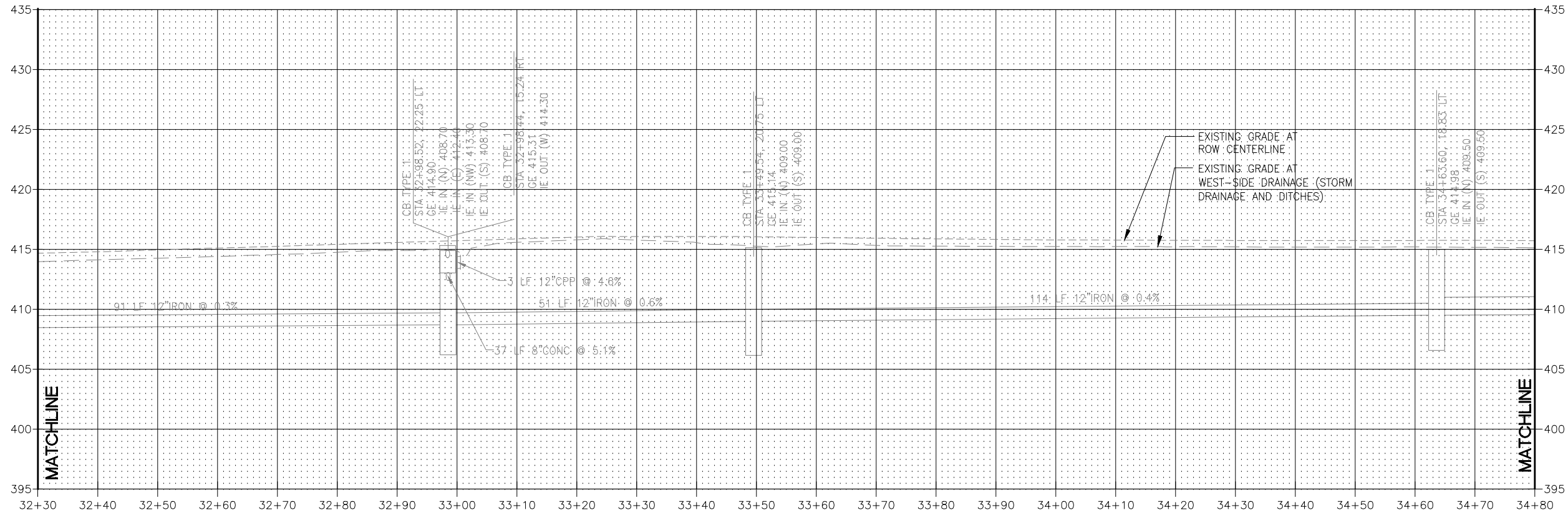
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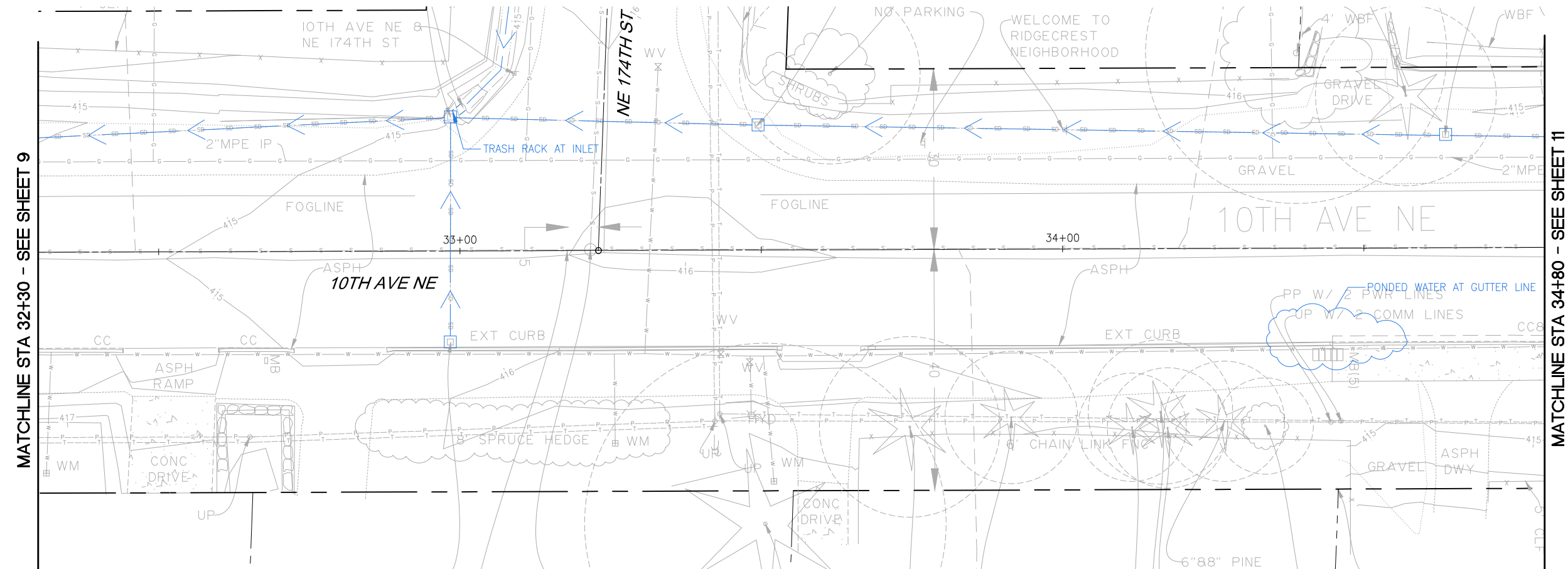
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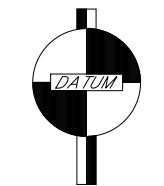
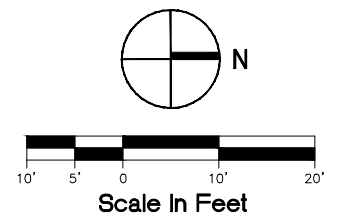
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Initials	Date	Description
KA	March - May 2014	Drawn
LK	March - June 2014	Designed
PB	June 2014	Checked
		Revisions
		Revisions



17544 Midvale Ave. N  
Shoreline, WA 98133  
(206) 546-1700

**10th Ave NE -  
NE 165th to NE 175th  
Drainage**

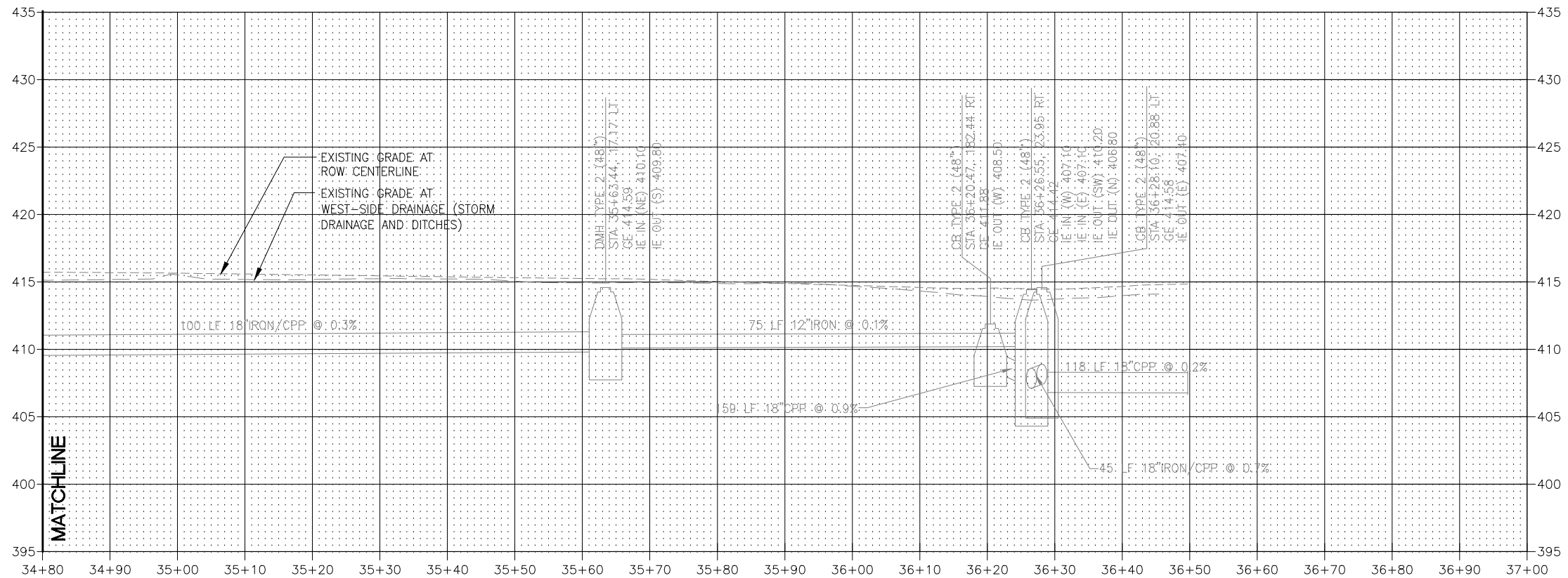
Project No. 13044

Sheet

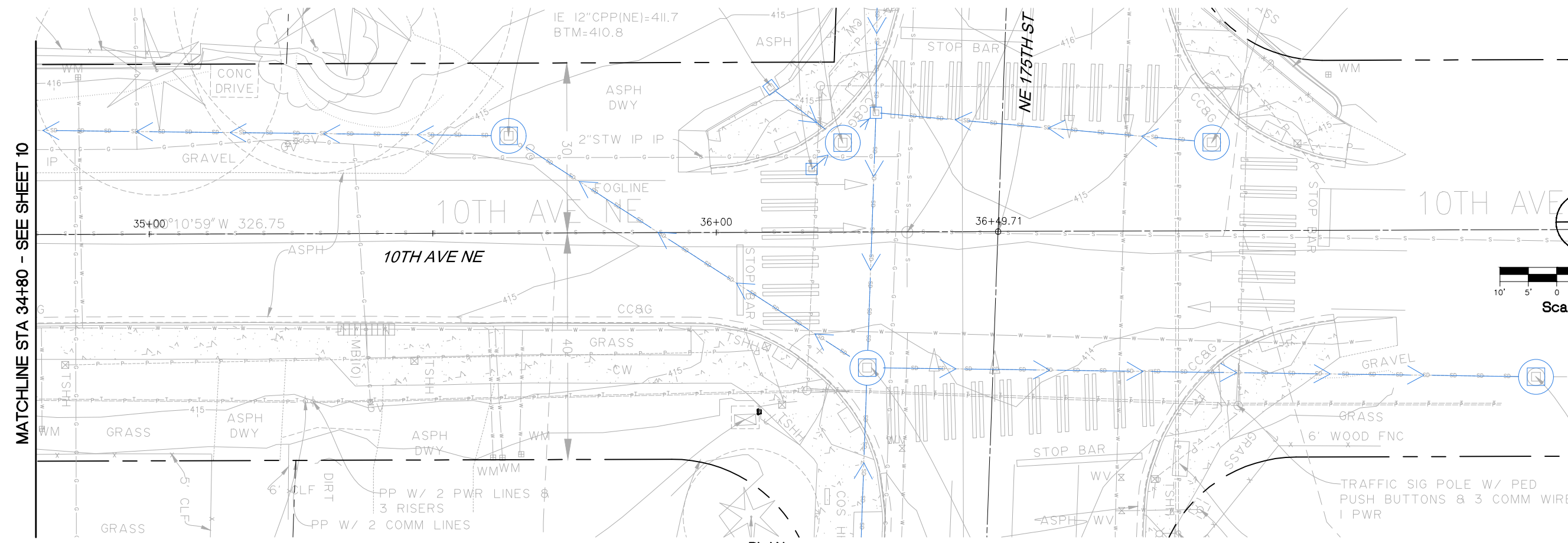
10

Sheet 10 of 11

Jun 09, 2014 - 2:20pm kylea c:\3c\13044\10c\_10TH\Current\10TH\_Plan.dwg



PROFILE



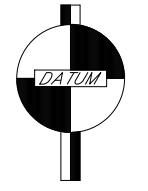
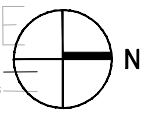
PLAN

Initials	Date	Description
KA	March 2014	Drawn
LK	May 2014	Designed
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	June 2014	Revisions
		Revisions



17544 Midvale Ave. N  
Shoreline, WA 98133  
(206) 546-1700

# 10th Ave NE - NE 165th to NE 175th Drainage



BASIS OF BEARING:  
NAD 83/91  
DATUM: NAVD 88

**CALL TWO BUSINESS  
DAYS BEFORE YOU DIG  
1-800-424-5555**

Jun 09, 2014 - 2:20pm  
kylea  
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