

June 12th, 2023

Project #14137

Geo File No. 07-SS-1366

To: Neetu Bhatti, Project Manager, McElhanney Ltd.

CC: Grant Irvine, P.Eng., Highway Design Liaison, Stantec Consulting Ltd.

Michael Carreira, P.Eng., Highway Design Project Manager, R. F. Binnie

Re: Geotechnical Design Recommendations – Aurum Road Washout (Approx. N49.486511°, W121.252942°)

1.0 Introduction

Aurum Road was washed out at this location in November 2021, as a result of an “Atmospheric River” weather event. The washed out section of Aurum Road is located approximately 1.28 km north of its intersection with Hwy 5. A location plan is attached to this memorandum.

Discussions on possible causes of the November 2021 event and details of the post-event field observations at the Site can be found in a separate geotechnical memorandum titled “Re: Review of Roadway Washout along Siwash Creek Road North of Hwy 5” and dated November 2nd, 2022. It should be noted that Aurum Road is also known as Siwash Creek Road.

Based on the memorandum titled “Analysis of Roadway Repair Options – Aurum Road Washout” prepared by R.F. Binnie & Associates Ltd. (Binnie), it is understood that Option 2 – Road Realignment is recommended and selected for the detailed design and the road restoration implementation. The Option 2 design drawing package is attached to this memorandum.

This memorandum includes a summary of the site bedrock, soil and groundwater characterizations and also provides my geotechnical recommendations on the detailed design of the road realignment option as recommended in the Binnie’s memorandum. A draft memorandum was sent to you on April 17th, 2023. This is a final version of that memorandum with the design team’s review comments addressed.

2.0 Bedrock, Soil and Groundwater Characterizations

2.1 Bedrock

Based on a review of bedrock maps available at iMapBC¹, it is indicated that the Site is generally underlain by a sedimentary bedrock which may consist of Lower Jurassic to Middle Jurassic mudstone, siltstone, shale fine clastic sedimentary rocks. This is generally consistent with the exposed sedimentary bedrock observed at the washout site during the ground reviews in June 2022.

2.2 Soil

Local surficial geological mapping was not found for the Site at iMapBC or at Geological Survey of Canada (GSC). Based on the field observations in June 2022, the soils exposed by the failure primarily consisted of sand and gravel with cobbles and boulders over bedrock.

¹ Reviewed on April 4th, 2023 at maps.gov.bc.ca

Based on the 2022 LiDAR survey information by McElhanney Ltd. (McElhanney) and the exposed bedrock in the washout areas, the thickness of the overburden below the existing Aurum Road was estimated to be less than 30 m at and in the vicinity of the washout location. The LiDAR survey data indicate that the existing natural slopes typically range from 1.4H:1V to 1.5H:1V in the washout areas along Aurum Road, which is generally consistent with the site observations.

2.3 Groundwater Conditions

During the ground reviews in June 2022, groundwater was noted to exit at the base of the native sand and gravel deposit and immediately above the bedrock surface. No seepage was noted anywhere else along the exposed overburden slope or headscarps, which indicates that the natural deposit at the Site is highly permeable. The groundwater table is estimated to be at the bedrock surface under normal conditions however, it is expected that the groundwater table at the Site could fluctuate seasonally in response to local precipitation and snow melt.

3.0 Design Standards

Below is a list of relevant design standards adopted by the Ministry of Transportation and Infrastructure (MoTI), which will be implemented in the design for the recovery work for the Aurum Road Washout.

- Canadian Highway Bridge Design Code (CHBDC), CSA S6:19.
- MoTI Bridge Standards and Procedures Manual, Supplement to CHBDC S6:19.
- MoTI Technical Circular T-04/17, Geotechnical Design Criteria.
- BC Supplement to TAC Geometric Design Guide (2019).

4.0 Geotechnical Design Recommendations

Based on the ground information observed during the site visits and as discussed above, I have provided the following geotechnical considerations and recommendations for design and construction of Option 2 – Road Realignment at this washout location.

4.1 Seismic Design Considerations

The natural soil deposits at the Site consist of compact sand and gravel over bedrock. The site is interpreted as Site Class D for seismic site response based on Table 4.1 of CHBDC S6:19. The 2015 National Building Code of Canada (NBCC2015) Seismic Hazard Calculation for Site Class C is attached for seismic designs. Design response spectral acceleration values can be calculated for Site Class D based on site coefficients and formulas provided respectively in Tables 4.2 to 4.9 in Section 4.4.3.3 and Section 4.4.3.4 of CHBDC S6:19.

The compact sand and gravel deposit at the Site is considered to be low liquefaction potential during a seismic event, particularly in consideration of the low groundwater table under normal conditions.

4.2 Cut and Fill Slopes

As shown on the attached drawings of “Option 2 – Road Realignment” by Binnie, it is understood that cut and fill slopes will be required in the design. A summary of slope stability analysis results is provided in this section for the proposed cut and fill slopes, together with slope design recommendations.

It should be noted that the slope design recommendations provided here are for slopes modified within the current project limits, i.e., for any new cut or fill slopes. In consideration of the current recovery project scope, those slopes not modified will be left in their ambient condition.

4.2.1 Slope Stability Design Criteria

For static loading conditions, the minimum slope stability design requirement is specified in Table 6.2b of MoTI Supplement to CHBDC S6:19. For the recovery project of this washout section, a typical degree of understanding and a low consequence factor were considered resulting in a required minimum factor of safety (FoS) of 1.34 for global stability of a permanent slope under static loading conditions. Justifications for these selections are further discussed below.

For slopes under seismic loading conditions, based on the requirement in Technical Circular T-04/17 and Section 6.14.2.3 of MoTI Supplement to CHBDC S6:19, a minimum pseudo-static FoS of 1.1 under 475-year ground motion is required for the recovery project of this washout section along Aurum Road which is classified as “Other”.

1) Degree of Understanding

The soil stratigraphy and properties together with groundwater conditions were reviewed closely during the site visits in June 2022. At the failure location the complete native overburden profile of sand and gravel is exposed along the headscarps of the washout channel, with bedrock exposures at the base of the channel. The LiDAR survey data indicate that the existing natural slopes typically range from 1.4H:1V to 1.5H:1V in this washout section along Aurum Road, which are generally consistent with the site observations. In addition, near vertical headscarps of up to 10m high were noted in the washout area. Therefore, based on the above information and a back analysis, the native sand and gravel deposit is estimated to have a friction angle of 35 degrees or greater and have a relative density of compact at minimum.

Any new fill will be selected, placed and compacted according to the Ministry (MoTI) Standard Specifications for Highway Construction and its properties are well established.

Considering the above, a typical degree of understanding is considered to be appropriate for the stability analysis of this Site.

2) Consequence Factor

Here are reasons for a low consequence factor selected for the realignment design.

- Aurum Road is a gravel surfaced low volume road and used only as an access to a mine site and for recreational purposes.

- The native overburden consists of granular or cohesionless materials. If any slope failure occurs, it will very likely be triggered by raised porewater pressures or erosions which typically occur during a wet season with minimal road users.
- Aurum Road has an entrance gate which can be fully closed for any vehicle access during an emergency event.

4.2.2 Slope Stability Design Parameters

The soil parameters selected for the stability analyses were based on a back analysis and previous experience on similar materials and are summarized in Table 1 below.

Table 1. Soil Parameters Selected for Stability Analyses

MATERIAL	FRICITION ANGLE Φ' (Degree)	COHESION c' (kPa)	UNIT WEIGHT γ_{sat} (kN/m ³)
Rockfill (Engineered Fill)	40	0	22
Granular Fill (Engineered Fill)	36	0	20
Sand and Gravel (Native Deposit, Cobbly)	35	0	19
Bedrock	Impenetrable		

The piezometric conditions used for the stability analyses were based on the highly permeable native deposits over bedrock and on the groundwater conditions observed during the field reviews.

A traffic surcharge of 12 kPa is assumed in the stability analyses.

4.2.3 Slope Stability Analysis

The slope stability analysis was completed using the Morgenstern-Price (M-P) method of analysis available in the Geo-Studio Slope/W software package for limit equilibrium stability analysis. Circular slips and effective stress analyses were used to identify critical slip surfaces.

Representative geometry used in the stability model was based on the LiDAR survey data and the attached Option 2 design cross-section at Sta. 101+40. The results are summarized in Table 2 below and the typical stability model output can be found in Figures 1 to 8.

Table 2. Summary of Stability Analysis Results

Case No.	Case Description	Estimated FoS	Figure No.
1a	1.75H:1V Cut Slope of 10m-High Headscarp (Static Loading)	1.37	1
1b	1.75H:1V Cut Slope of 10m-High Headscarp (Seismic Loading)	1.17	2
2a	1.75H:1V Cut Slope of STA101+40 (Static Loading)	1.46	3
2b	1.75H:1V Cut Slope at STA101+40 (Seismic Loading)	1.26	4

3a	1.75H:1V Granular Fill Slope of STA101+40 (Static Loading)	1.38	5
3b	1.75H:1V Granular Fill Slope at STA101+40 (Seismic Loading)	1.19	6
4a	1.75H:1V Rockfill Slope of STA101+40 (Static Loading)	1.54	7
4b	1.75H:1V Rockfill Slope of STA101+40 (Seismic Loading)	1.32	8

4.2.4 Slope Stability Design Recommendations

Based on the slope stability analysis, it is recommended that a slope angle of 1.75H:1V or flatter be used for both cut and fill slopes to meet the slope stability design criteria as discussed in Section 4.2.1. Further detailed slope design recommendations are provided below.

- **Cut Slopes**

All permanent cut slopes should be sloped at 1.75H:1V or flatter. The near-vertical headscarps should be excavated and cut back at a slope angle of 1.75H:1V or flatter. It is highly recommended that slope cuts or ground disturbance be minimized along the existing slopes at the mountain side of the proposed realignment.

All loose or disturbed materials along the cut slope should be well compacted using a moderate to heavy plate tamper or hoe pack. Efforts should be made to revegetate the finished slope as recommended by a qualified R.P.Bio. to prevent surficial erosion.

- **Fill Slopes**

For any area where backfill is required, organic matter should be removed, and all loose or disturbed materials should be well compacted using a moderate to heavy plate tamper or hoe pack prior to any new fill placement. Backfill should consist of clean sand and gravel materials or rockfill as approved by the Geotechnical Engineer and should have a slope angle of 1.75H:1V or flatter.

When sand and gravel materials are selected as backfill, the use of 75mm WGB as per Section 202 of the Ministry Standard Specifications is recommended. Revegetation of the finished slope should be considered.

When rockfill is selected as backfill, the materials used for rockfill should be clean, hard, dense, durable and well graded shot rock not exceeding 300 mm (12”) in size. In addition, a 75mm-WGB layer of 1m-thick is highly recommended to be placed between the existing ground and the new rockfill as a filter layer.

- **Concrete Roadside Barriers (CRBs)**

Placement of Concrete Roadside Barriers (CRBs) is recommended along the washout area and the finished slope area for traffic safety.

4.3 Geotechnical Considerations for CSP Culvert Installation

The proposed CSP Culverts should be installed to meet the requirements specified in Section 303 in the latest version of the Ministry Standard Specifications (SS) for Highway Construction,

including but not limited to backfilling/bedding/embedment materials, excavation, subgrade preparation, fill placement and culvert installation.

It is recommended that 25mm Well Graded Base (WGB) course be used as bedding and embedment materials for the culvert installation. Other suitable materials should be approved by the Geotechnical Engineer and a low-permeability end seal may be required at the upstream end for a culvert with no end wall or cut-off wall (as per SS 303.20).

For any riprap protection over the existing overburden at the inlet or outlet area, a layer of non-woven geotextile should be placed along the excavated surface prior to riprap placement.

Inadequate cover above the CSP culvert may compromise the performance of the culvert itself and the performance of the running surface of the road. Accordingly, it is recommended that for culverts less than 3 m in diameter, a minimum cover of 450 mm (measured from the finished shoulder grade) over the crown of the pipe is required as per Section 1040.02 of BC Supplement to TAC Geometric Design Guide (2019).

4.4 Subgrade Preparation

Organic matter should be removed, and all loose or disturbed materials should be well compacted following the requirements in the latest version of the Ministry (MoTI) Standard Specifications for Highway Construction. The Geotechnical Engineer or their field representative should be notified prior to any further construction activities. Any required subgrade improvements should be reviewed and directed by the Geotechnical Engineer.

4.5 Revegetation

Revegetation of the finished slopes and any disturbed ground is highly recommended in order to protect against surficial erosion. Advice on revegetation should be obtained from a qualified R.P.Bio.

4.6 Pavement Structure

As per the Ministry's Technical Circular T-01/15, it is recommended to use Pavement Structure Type D with 150mm of HFSA, 225mm of 25mm WGB and 150mm of SGSB.

4.7 Non-Woven Geotextile

Non-woven geotextile is recommended for any riprap or rockfill placement over the existing overburden. Non-woven geotextile should be selected from the current edition of the Ministry's Recognized Products List (RPLs) and should meet the minimum requirements as listed in Table 3 below. All joints of non-woven geotextile shall be overlapped by minimum 0.5m, or as specified by the manufacturer, whichever is greater.

Table 3. Minimum Requirements for Non-woven Geotextile

Parameter	Test Method	Value*
Grab Strength	ASTM D4632	≥ 900 N

Sewn Seam Strength	ASTM D4632	≥ 810 N
Tear Strength	ASTM D4533	≥ 350 N
Static CBR Puncture Strength	ASTM D6241	$\geq 1,925$ N
Permittivity	ASTM D4491	≥ 0.2 s ⁻¹
Apparent Opening Size (AOS)	ASTM D4751	≤ 0.25 mm
UV Stability	ASTM D4355	$\geq 50\%$ @ 500 hrs

* All values are minimum average roll values except AOS which is a maximum average roll value.

4.8 Field Reviews

The Geotechnical Engineer should be notified prior to any construction activities and will be on-site or arrange for a field representative to complete field reviews for any earthworks such as excavation, material placement and compaction.

Please let me or the undersigned know if you have any questions or concerns.

Prepared by

Reviewed by

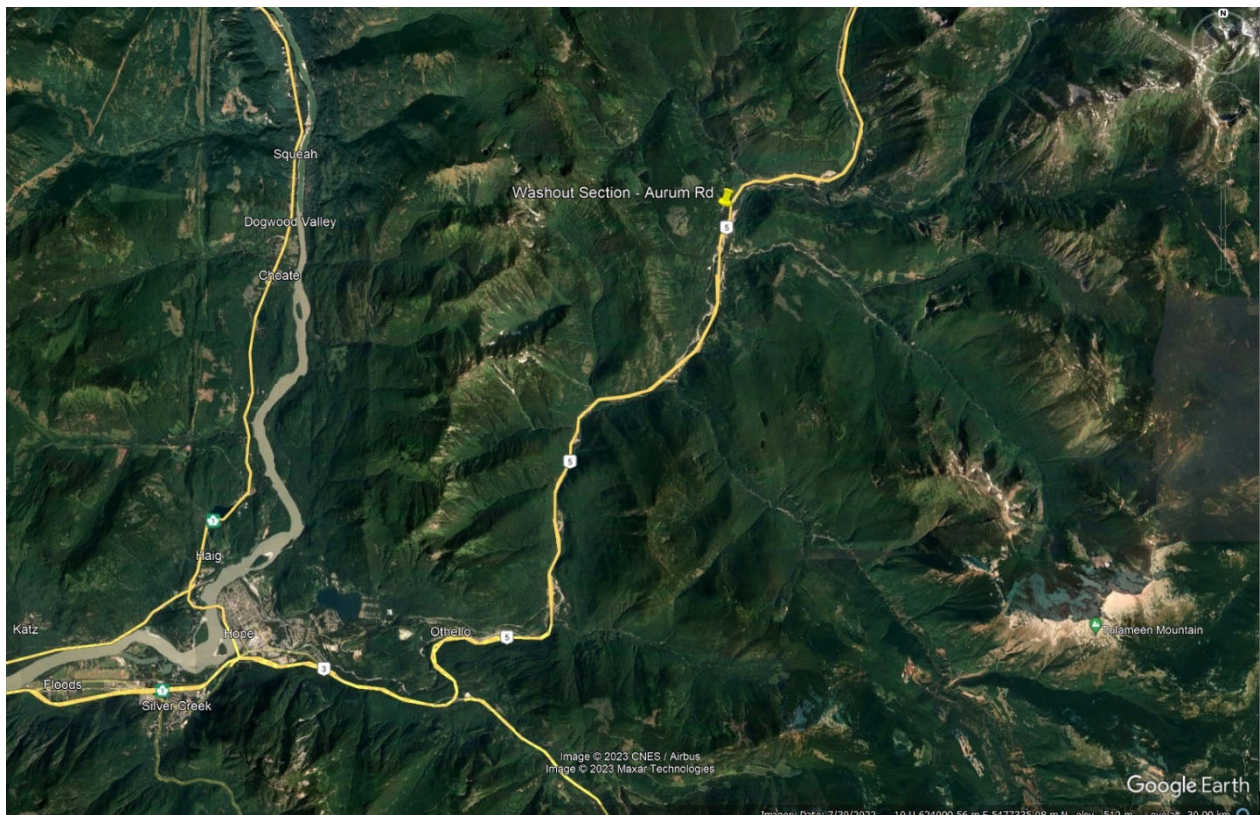
Kevin Ye, Ph.D., P.Eng.
Geotechnical Engineer
Ministry of Transportation and Infrastructure
(EGBC Permit No. 1003429)



Scott Cosman, P.Eng.
Lead Geotechnical Engineer
Ministry of Transportation and Infrastructure
(EGBC Permit No. 1003429)

Attachments:

Location Plan (1 page),
Typical Stability Model Output (4 pages),
2015 NBC Seismic Hazard Calculation (1 page), and
Option 2 – Road Realignment Design Drawings by R.F. Binnie (26 pages).



Location Plan (Not to Scale)

– Roadway Washout along Aurum Road North of Hwy 5, Hope

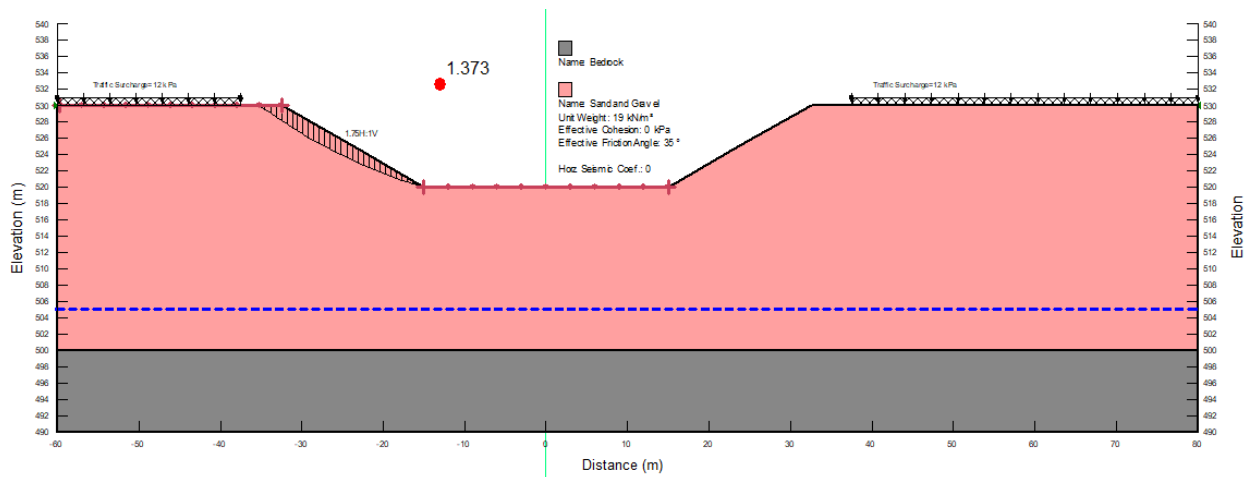


Figure 1 – 1.75H:1V Cut Slope of 10m-High Headscarp Based on LiDAR Survey Data under Static Loading Conditions.

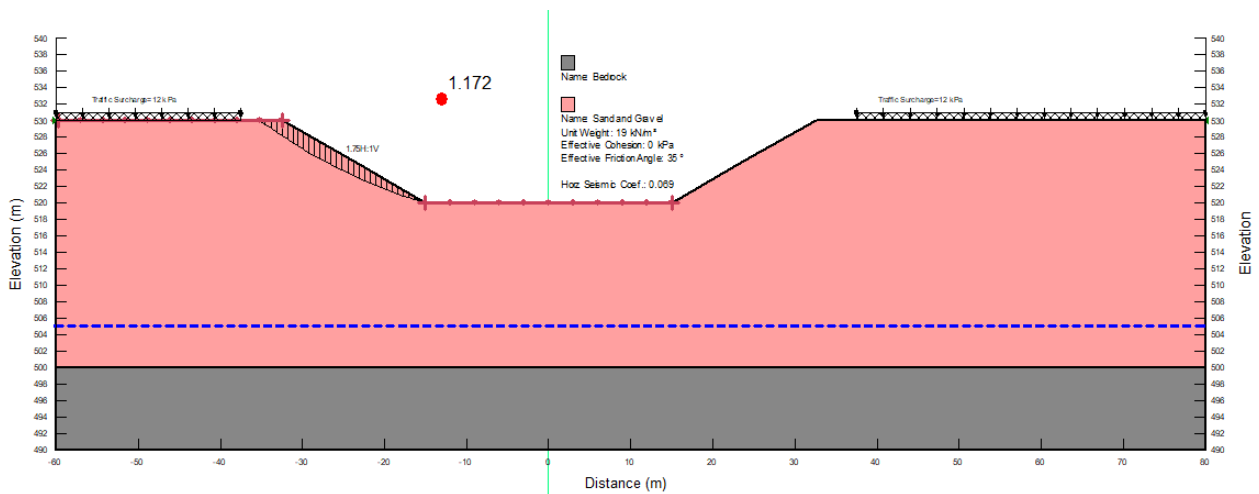


Figure 2 – 1.75H:1V Cut Slope of 10m-High Headscarp Based on LiDAR Survey Data under Seismic Loading Conditions of 475 Year Ground Motion with a Full PGA of 0.069g.

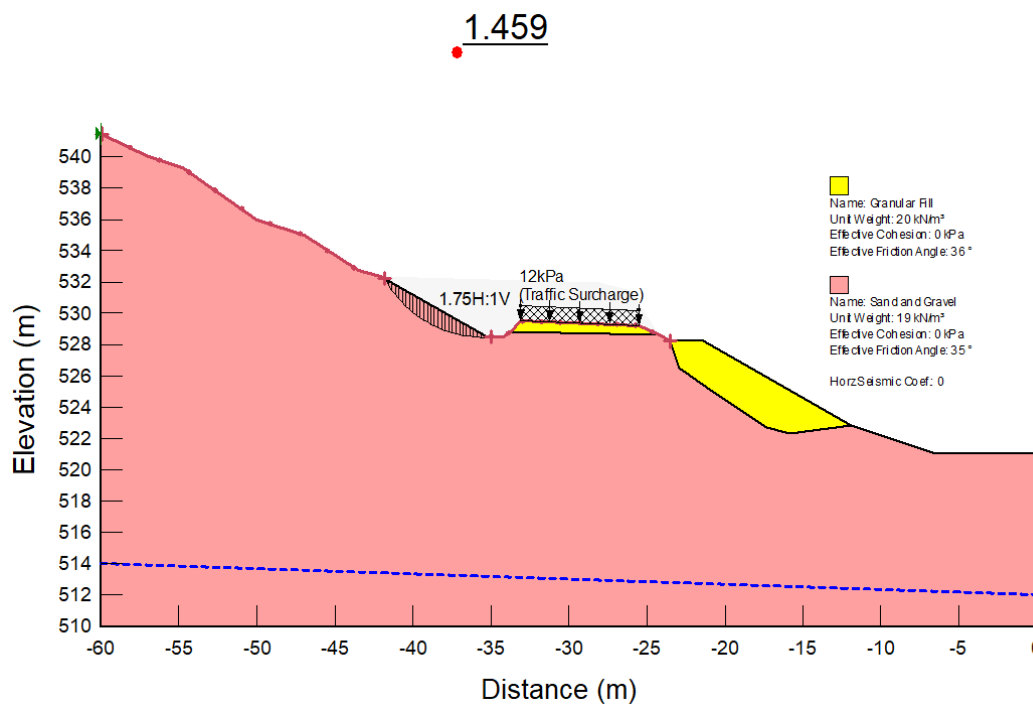


Figure 3 – 1.75H:1V Cut Slope of Option 2 Design Cross Section at Station 101+40 under Static Loading Conditions.

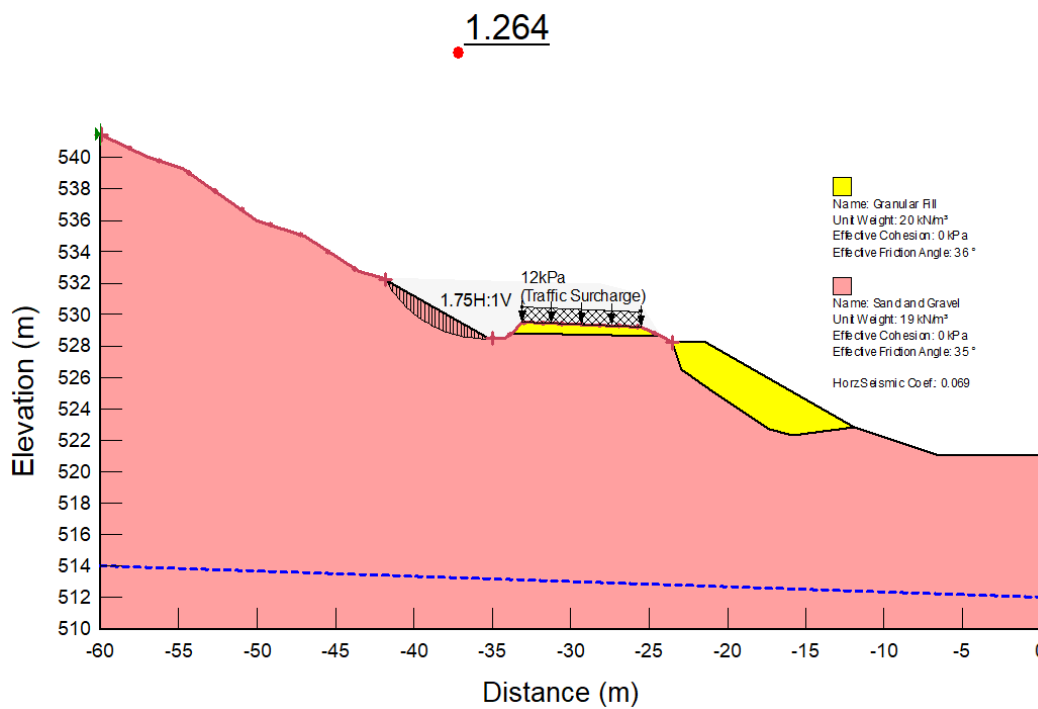


Figure 4 – 1.75H:1V Cut Slope of Option 2 Design Cross Section at Station 101+40 under Seismic Loading Conditions of 475 Year Ground Motion with a Full PGA of 0.069g.

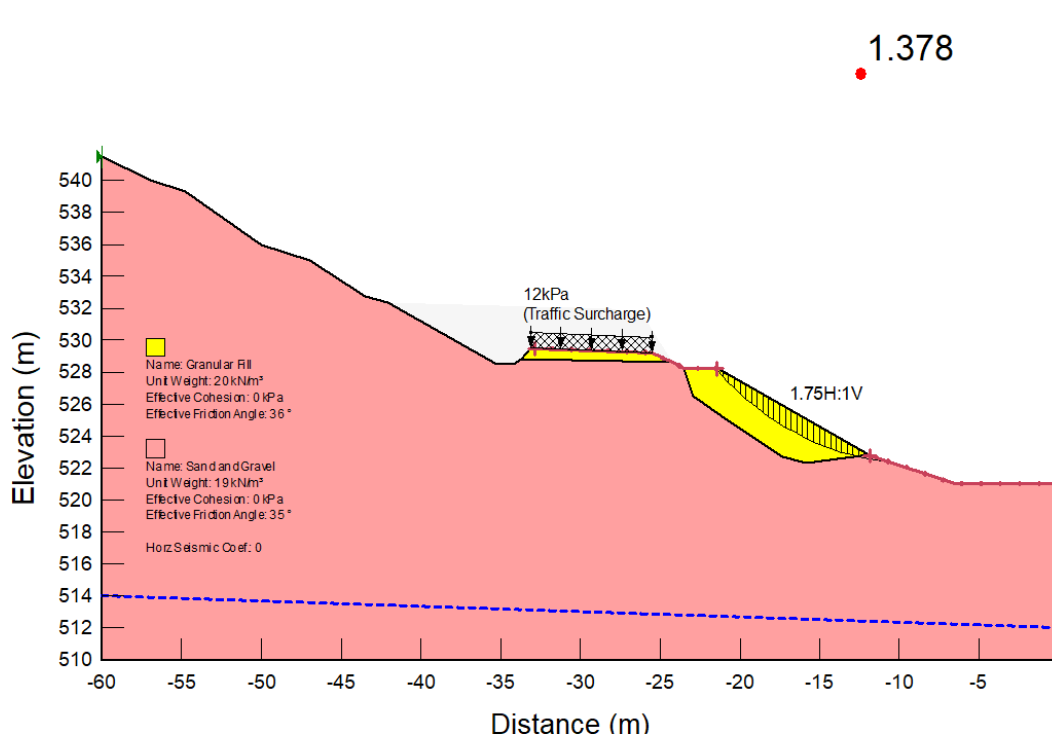


Figure 5 – 1.75H:1V Granular Fill Slope of Option 2 Design Cross Section at Station 101+40 under Static Loading Conditions.

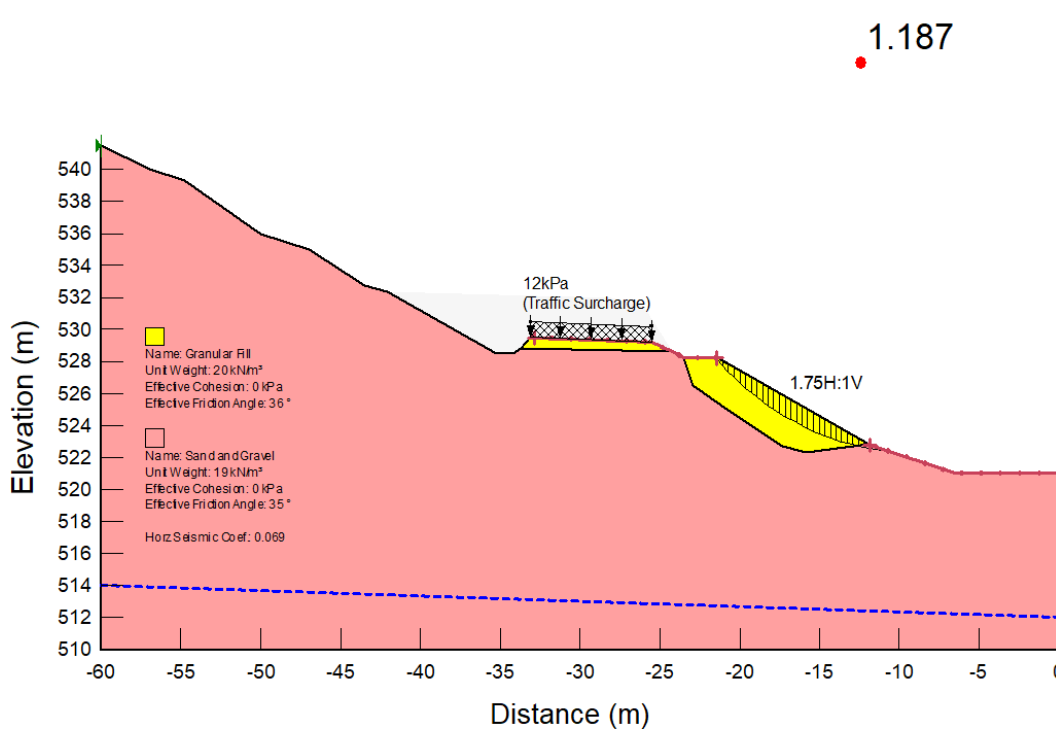


Figure 6 – 1.75H:1V Granular Fill Slope of Option 2 Design Cross Section at Station 101+40 under Seismic Loading Conditions of 475 Year Ground Motion with a Full PGA of 0.069g.

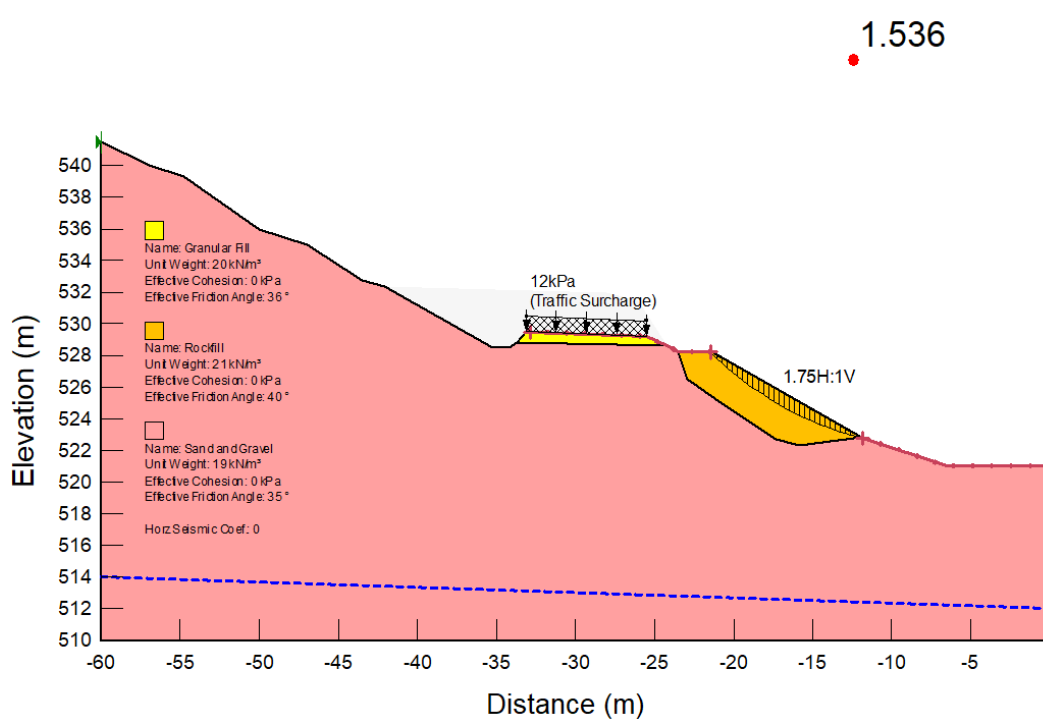


Figure 7 – 1.75H:1V Rockfill Slope of Option 2 Design Cross Section at Station 101+40 under Static Loading Conditions.

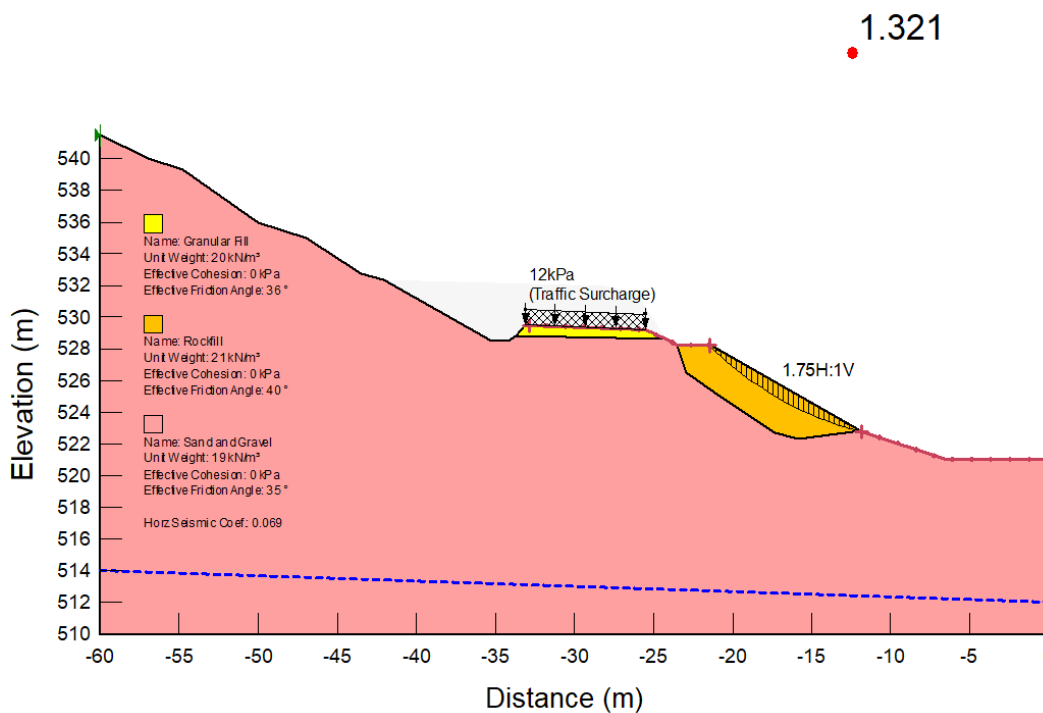


Figure 8 – 1.75H:1V Rockfill Slope of Option 2 Design Cross Section at Station 101+40 under Seismic Loading Conditions of 475 Year Ground Motion with a Full PGA of 0.069g.

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 49.487N 121.253W

User File Reference: Aurum Road Washout

2023-04-04 18:51 UT

Requested by: Kevin Ye, BC MoTI

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.181	0.115	0.079	0.031
Sa (0.1)	0.268	0.171	0.117	0.047
Sa (0.2)	0.330	0.220	0.155	0.066
Sa (0.3)	0.314	0.216	0.155	0.069
Sa (0.5)	0.272	0.188	0.135	0.059
Sa (1.0)	0.183	0.122	0.085	0.035
Sa (2.0)	0.119	0.077	0.051	0.021
Sa (5.0)	0.047	0.027	0.016	0.005
Sa (10.0)	0.015	0.009	0.006	0.002
PGA (g)	0.153	0.100	0.069	0.027
PGV (m/s)	0.228	0.146	0.098	0.038

Notes: Spectral ($S_a(T)$, where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s . Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information



Ministry of
Transportation
and Infrastructure

PROJECT NO. 14137

AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

FOR DISCUSSION ONLY - MAR. 31, 2023

IAN PILKINGTON, CHIEF ENGINEER

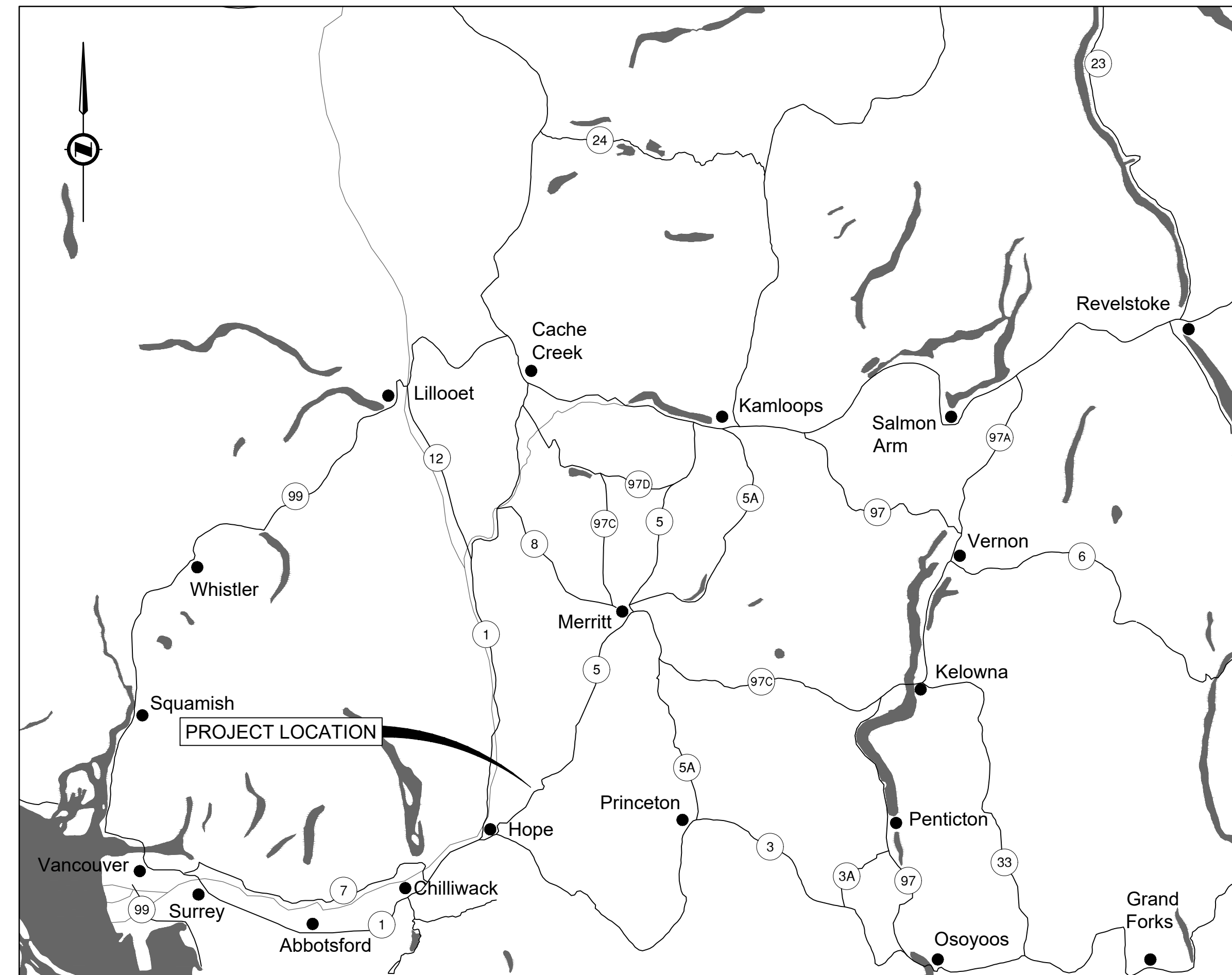
SOUTH COAST REGION

PROJECT NO. 14137

**AURUM ROAD WASHOUT
 OPTION 2 - ROAD REALIGNMENT**

DRAWING INDEX



R1-1073-001 to 002	KEY PLAN AND LEGEND
R1-1073-101 to 102	PLANS
R1-1073-201	PROFILES
R1-1073-301	TYPICAL SECTIONS



LOCATION MAP
 N.T.S.

DRAFT

FOR DISCUSSION ONLY - MAR. 31, 2023

 <p>The people behind your infrastructure.</p>		<p>R.F. BINNIE & ASSOCIATES LTD. 300 - 4940 Canada Way, Burnaby, BC V5G 4K6 TEL 604 420 1721 BINNIE.com</p>			
 <p>BRITISH COLUMBIA</p>		<p>MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE SOUTH COAST REGION HIGHWAY ENGINEERING AND GEOMATICS</p>			
<p>KEY PLAN AURUM ROAD WASHOUT OPTION 2 - ROAD REALIGNMENT</p>					
<p>REFER TO TENDER DRAWING PACKAGE APPROVAL FORM</p> <p>DIRECTOR OF ENGINEERING</p>		<p>REFER TO TENDER DRAWING PACKAGE APPROVAL FORM</p> <p>EXECUTIVE REGIONAL DIRECTOR</p>			
DATE	FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
	22-0953	14137	1	R1-1073-001	

LEGEND

AERIAL UTILITIES (EXISTING)

Deadman	
Anchor / Guy Wire	
High Tension Pole	
High Tension Tower	
Power Guy Pole	
Power / Phone Guy Pole	
Power Poles	
Power Pole with Transformer	
Power / Phone Pole with Transformer	
Power / Phone Pole	
Telephone Pole	
Telephone Guy Pole	
Pedestal (B.C. Tel.)	
Telephone Booth	

SURVEY (EXISTING)

Bench Mark	
Standard Iron Pin	
Lead Plug	
Wooden Post	
Witness Post	
Reference Point	
Monument	
Aluminum Post	
Angle Iron Post	
Standard Brass Cap Monument	
Concrete Post Monument	
Dominion Iron Post	
Unmarked Measured Point	
Rock Post Monument	
Non- Standard Round Iron Post	
Non-Standard Square Iron Post	
Detail Hub (etc.)	
Spot Elevation	

DETAIL (EXISTING)

Septic Field	
Concrete Pillar	
Guard Post	
Piling	
Gate Post	
Swamp	
Road Sign	
Well	
Tree	
Decorative Tree	
Delineator Post	
Flag Pole	
Mail Box	
Top of Bank	

DRAINAGE (EXISTING)

Catch Basin / Manhole	
Culvert Outlet	
Culvert Inlet	
Culvert Headwall	
Drainage Grate	
Manhole	
Catch Basin	
Culvert Kink	
Asphalt Spillway	

METERS (EXISTING)

Service Meter	
Water Meter	
Valve	
Water valve	
Fire Hydrant	
Gas Valve	
Observation Well	

UNDERGROUND (EXISTING)

Filler Cap	
Fuel / Gas Pump	
Fuel Tank	
Septic Tank	
Underground Marker	
Breather / Vent Pipe	

ELECTRICAL (EXISTING)

Traffic Signal Control Box	
Electrical Outlet	
Junction Box	
Kiosk	
Lamp Standard	
Traffic Signal	
Traffic Counter	

LEGAL LINETYPES (EXISTING)

International Bdy.	
Section / District Bdy.	
Parcel Boundary / Old road R/W	
Quarter Section	
Easement	
Agricultural Land Reserve	

MAN MADE FEATURES LINETYPES (EXISTING)

Crown of Existing Road	
Edge of Pavement	
Concrete Barrier	
Dirt Road / Driveway	
Fence	
Gravel Road / Driveway	
Hedge / Bush / Tree Line	
Railway	
Retaining Wall	
Guard Rail	
Paint Lines - Solid	
Paint Lines - Dashed	

UNDERGROUND UTILITIES LINETYPES (EXISTING)

Gas Main	
Oil	
Sanitary Sewer Line	
Storm / Sewer Drain	
Electrical Cable	
Miscellaneous	
Telephone Cable	
Water Main	
Culvert	

OVERHEAD UTILITIES LINETYPES (EXISTING)

High Tension Wire	
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HYDRAULIC LINETYPES (EXISTING)

Creek / Ditch / Stream	
Edge of Water	
Major Catchment Boundary	
Sub-Catchment Boundary	

GEOTECHNICAL (EXISTING)

Pavement Core With Label	
Test Pit With Label	
Drill Hole With Label	

DRAINAGE (PROPOSED)

Catch Basin	
Deck Drain	
Manhole	
Asphalt Spillway	
Ditch Inlet Structure	
Ditch Block	
Cleanout	
Asphalt Swale	
Special Ditching	
Culvert Outfall with Riprap Apron	
Culvert Headwall	
Riprap	

SIGNS (PROPOSED)

Road Sign (Single Pole)	
Road Sign (Double Pole)	
Post Mounted Delineator	
Commercial Message Sign	

LEGAL LINETYPES (PROPOSED)

Highway Right of Way	
Easement	

CONSTRUCTION DETAILS LINETYPES (PROPOSED)

Berm	
Clearing and Grubbing	
Pavement Sawcut Line	
Surplus Excavation Disposal Area	
Subgrade Pre-Build	

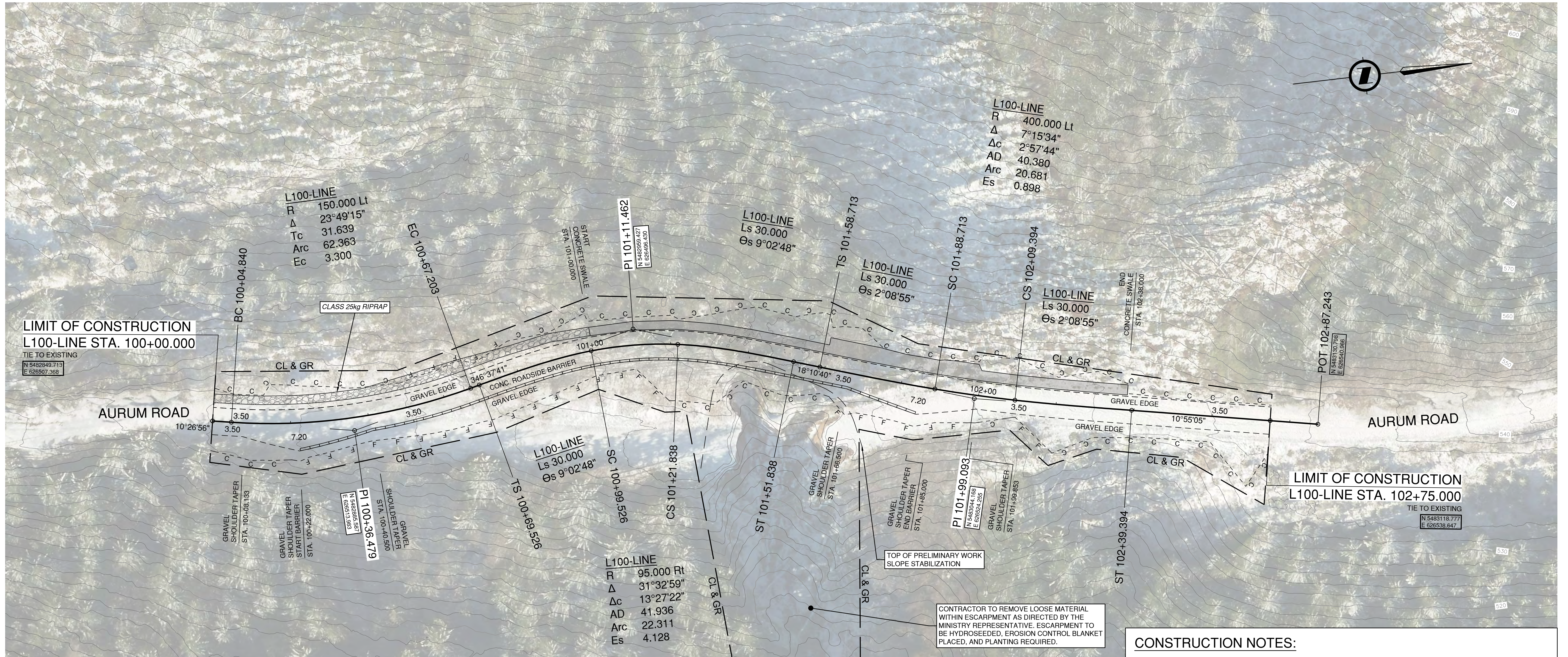
SURFACE (PROPOSED)

Centerline Alignment	
Edge of Pavement	
Concrete Barrier	
Slope Stake Line	
Fence	
Retaining Wall	
Paint Lines - Solid	
Paint Lines - Dashed	
Curb Line	
Trail	

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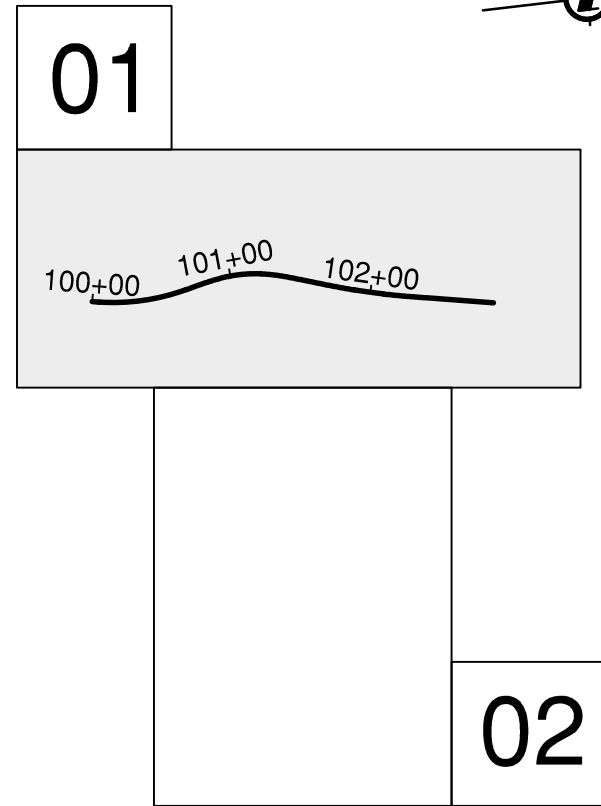
FOR DISCUSSION ONLY - MAR. 31, 2023

		R.F. BINNIE & ASSOCIATES LTD. 300 - 4940 Canada Way, Burnaby, BC V5G 4K6 TEL 604 420 1721 BINNIE.com				MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE SOUTH COAST REGION HIGHWAY ENGINEERING AND GEOMATICS				
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REV	DATE	REVISIONS	SIGNATURE							
DRAFT			MICHAEL CARREIRA ENGINEER OF RECORD DATE		DESIGNED _____ M.C. DATE MAR 2023 QUALITY CONTROL _____ M.C. DATE MAR 2023 QUALITY ASSURANCE _____ M.C. DATE MAR 2023 DRAWN _____ J.T. DATE MAR 2023		PROJECT NUMBER 14137	REG 1	DRAWING NUMBER R1-1073-002	REV



MATCH LINE SEE DWG. R1-1073-102

- CONSTRUCTION NOTES:**
- CLEARING AND GRUBBING SHALL FOLLOW THE BOUNDARY AS SHOWN ON THE DRAWINGS.
 - UNDERGROUND UTILITIES AS SHOWN MAY BE INCOMPLETE OR INACCURATE.
 - THE CONTRACTOR SHALL FIELD VERIFY UTILITY LOCATIONS PRIOR TO COMMENCING WORK. CONTRACTOR TO PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION.



FOR DISCUSSION ONLY - MAR. 31, 2023

FOR PLANS
SEE DWG. R1-1073-101 TO 102

FOR PROFILES
SEE DWG. R1-1073-201

FOR TYPICAL SECTIONS
SEE DWG. R1-1073-301

CLEARING AND GRUBBING
TOTAL THIS SHEET: 0.9102 ha

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MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SCALE 0 5 1:500 25m CAD FILENAME 100PL-02-AURUMRD_22-0953.DWG
DATE 2023-03-23
FILE NUMBER 22-0953

REV	DATE	REVISIONS	SIGNATURE

PLAN
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

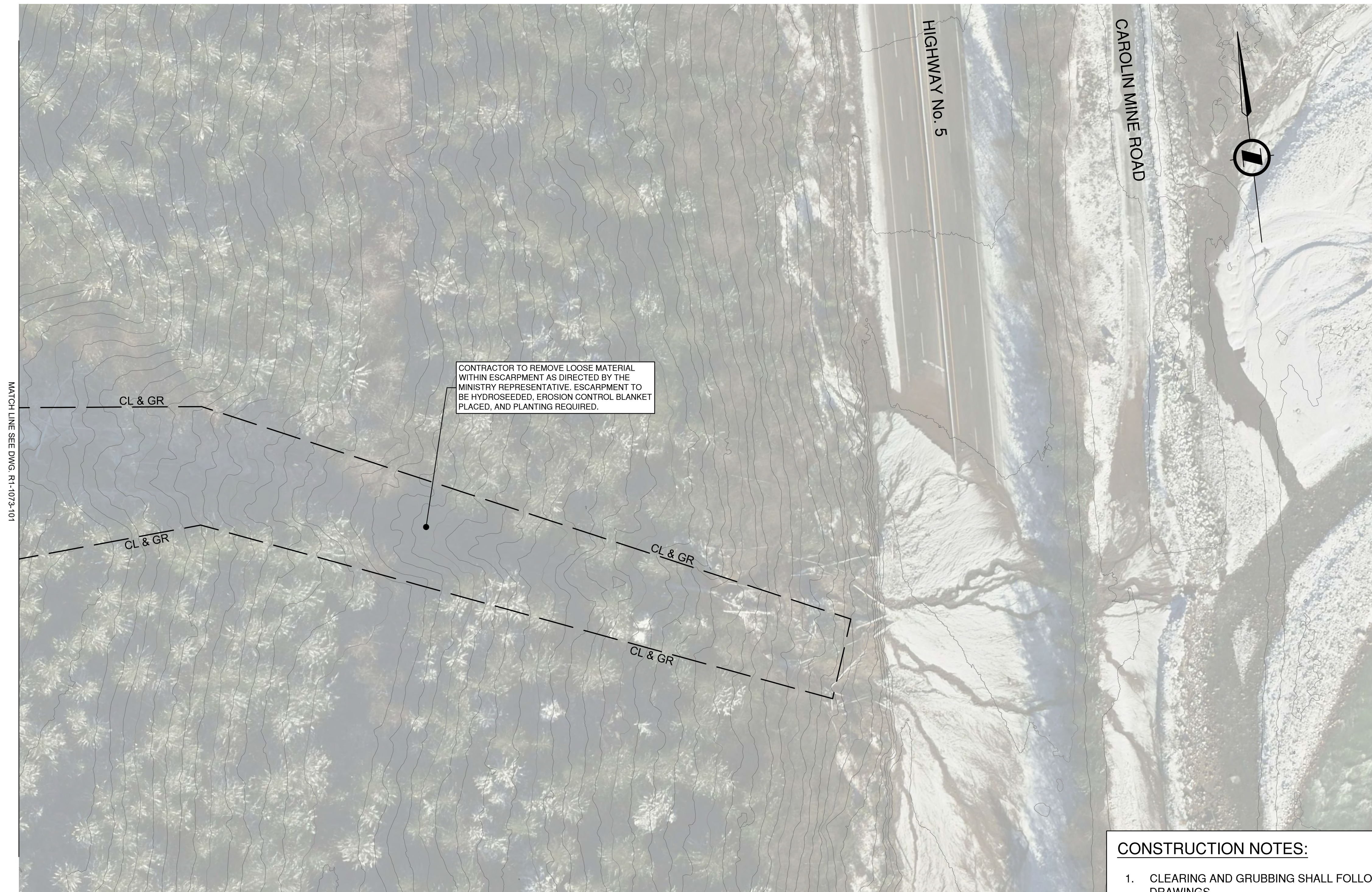
DRAFT

MICHAEL CARREIRA
ENGINEER OF RECORD
DATE

DESIGNED	M.C.	DATE	MAR. 2023
QUALITY CONTROL	M.C.	DATE	MAR. 2023
QUALITY ASSURANCE	M.C.	DATE	MAR. 2023
DRAWN	J.T.	DATE	MAR. 2023

PROJECT NUMBER	REG	DRAWING NUMBER	REV
14137	1	R1-1073-101	

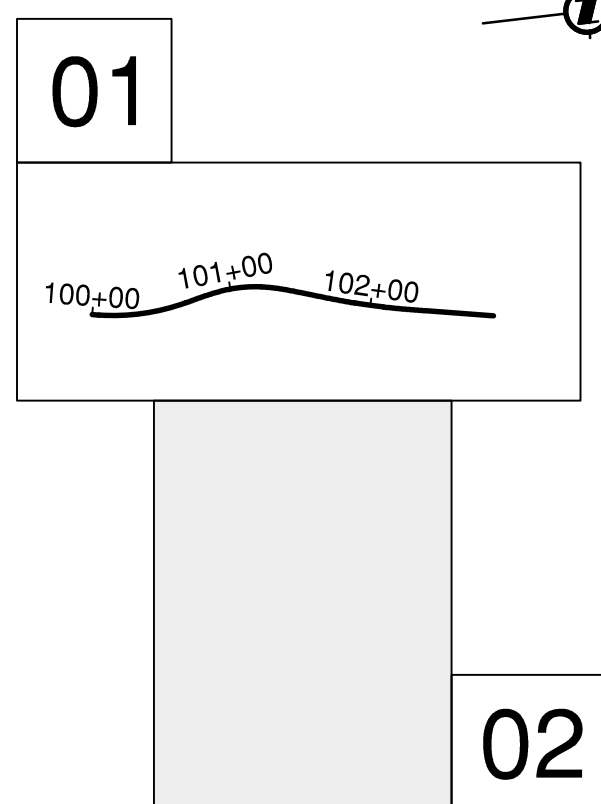
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CONTRACTOR TO REMOVE LOOSE MATERIAL WITHIN ESCARPMENT AS DIRECTED BY THE MINISTRY REPRESENTATIVE. ESCARPMENT TO BE HYDROSEEDED, EROSION CONTROL BLANKET PLACED, AND PLANTING REQUIRED.

MATCH LINE SEE DWG. R1-1073-101

- CONSTRUCTION NOTES:**
- CLEARING AND GRUBBING SHALL FOLLOW THE BOUNDARY AS SHOWN ON THE DRAWINGS.
 - UNDERGROUND UTILITIES AS SHOWN MAY BE INCOMPLETE OR INACCURATE.
 - THE CONTRACTOR SHALL FIELD VERIFY UTILITY LOCATIONS PRIOR TO COMMENCING WORK. CONTRACTOR TO PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION.



FOR DISCUSSION ONLY - MAR. 31, 2023

FOR PLANS
SEE DWG. R1-1073-101 TO 102

FOR PROFILES
SEE DWG. R1-1073-201

FOR TYPICAL SECTIONS
SEE DWG. R1-1073-301

CLEARING AND GRUBBING
TOTAL THIS SHEET: 0.4239 ha

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HIGHWAY ENGINEERING AND GEOMATICS

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FILE NUMBER 22-0953

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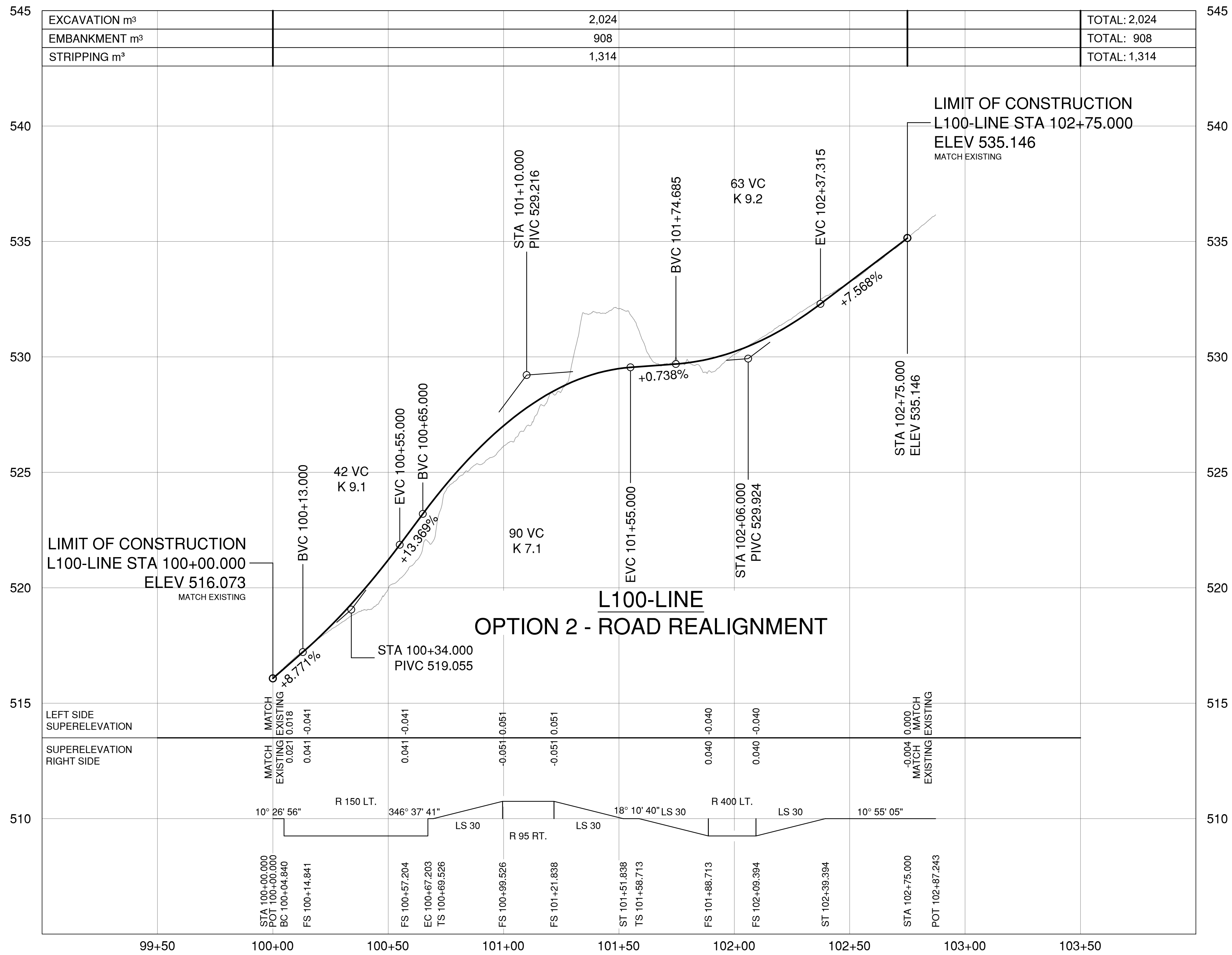
PLAN
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

DRAFT

MICHAEL CARREIRA
ENGINEER OF RECORD
DATE

DESIGNED	M.C.	DATE	MAR. 2023
QUALITY CONTROL	M.C.	DATE	MAR. 2023
QUALITY ASSURANCE	M.C.	DATE	MAR. 2023
DRAWN	J.T.	DATE	MAR. 2023

PROJECT NUMBER	REG	DRAWING NUMBER	REV
14137	1	R1-1073-102	



LEFT SIDE SUPERELEVATION	MATCH EXISTING	0.021	0.018	0.041	-0.041	-0.051	0.051	-0.051	0.040	0.040	-0.004	MATCH EXISTING	
SUPERELEVATION RIGHT SIDE	MATCH EXISTING	0.041	0.041	0.041	-0.051	-0.051	-0.051	-0.051	0.040	0.040	-0.004	MATCH EXISTING	
		10° 26' 56"	R 150 LT.	346° 37' 41"	LS 30	R 95 RT.	LS 30	18° 10' 40" LS 30	R 400 LT.	LS 30	10° 55' 05"		
		STA 100+00.000 POT 100+00.000 BC 100+04.840		FS 100+14.841		FS 100+57.204 EC 100+67.203 TS 100+69.526		FS 100+99.526 FS 101+21.838		ST 101+51.838 TS 101+58.713		FS 101+88.713 FS 102+09.394	ST 102+39.394

- NOTES:**
- ELEVATIONS SHOWN ARE FINISHED GRADE
 - EMBANKMENT FIGURES SHOWN ARE COMPACTED QUANTITIES
 - EXCAVATION FIGURES SHOWN ARE NEAT LINE UNADJUSTED QUANTITIES

L100-LINE (AURUM ROAD) - DESIGN SPEED 40 km/h

FOR DISCUSSION ONLY - MAR. 31, 2023

FOR PLANS
SEE DWG. R1-1073-101 TO 102

FOR PROFILES
SEE DWG. R1-1073-201

FOR TYPICAL SECTIONS
SEE DWG. R1-1073-301

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SCALE 0 10 50m H 1:1000 V 1:100
DATE 2023-03-23
FILE NUMBER 22-0953

REV	DATE	REVISIONS	SIGNATURE

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

L100-LINE PROFILE
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

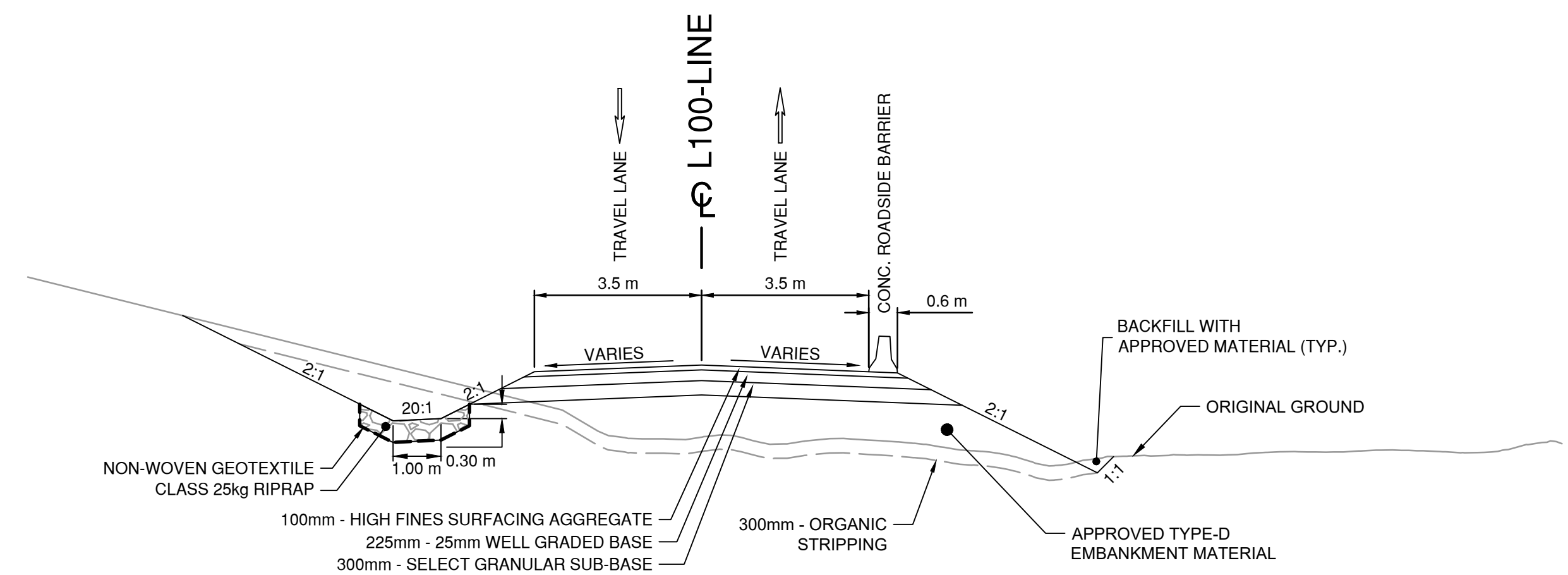
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DESIGNED: _____ M.C. DATE: MAR. 2023
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 QUALITY ASSURANCE: _____ M.C. DATE: MAR. 2023
 DRAWN: _____ J.T. DATE: MAR. 2023

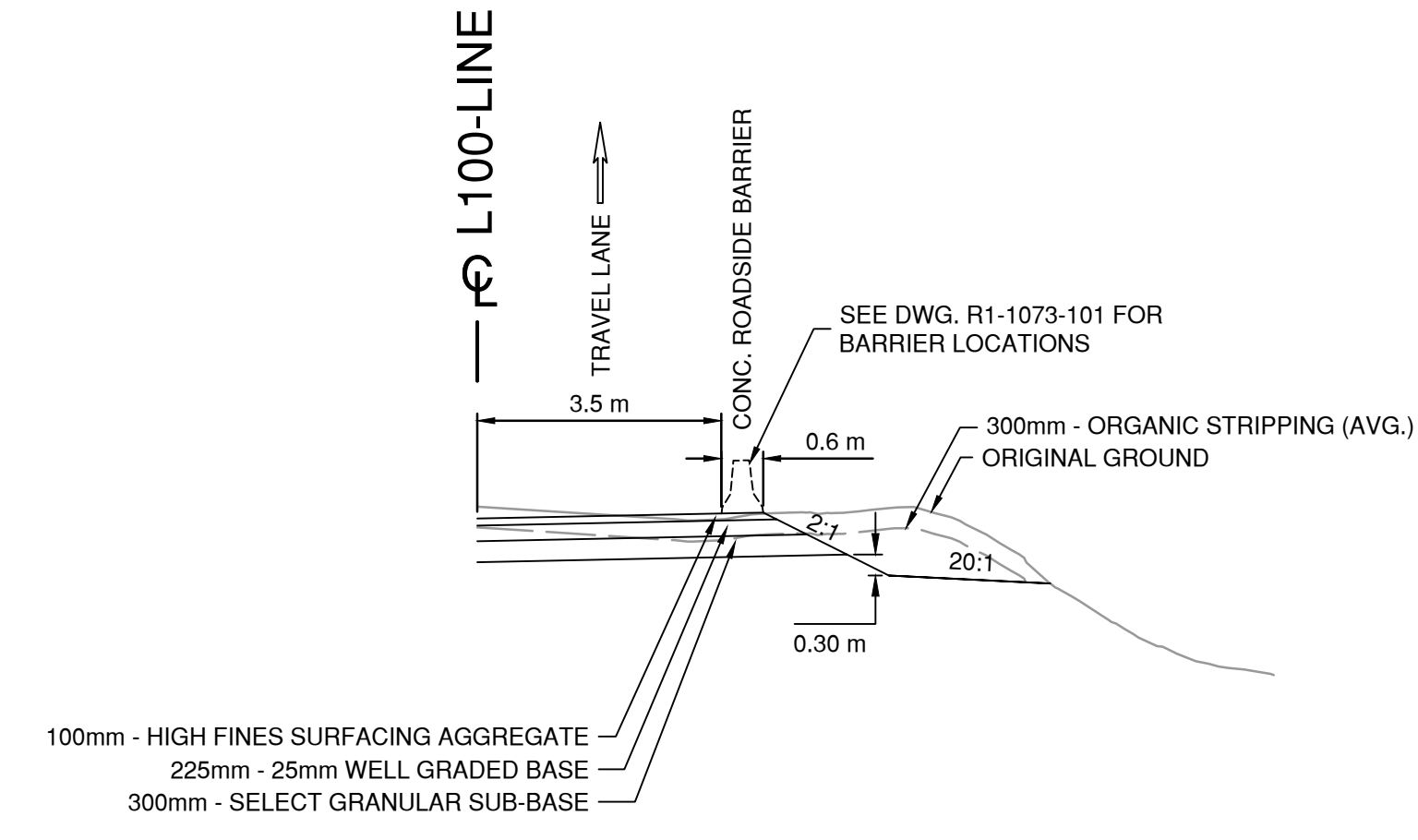
MICHAEL CARREIRA
ENGINEER OF RECORD
DATE: _____

PROJECT NUMBER	REG	DRAWING NUMBER	REV
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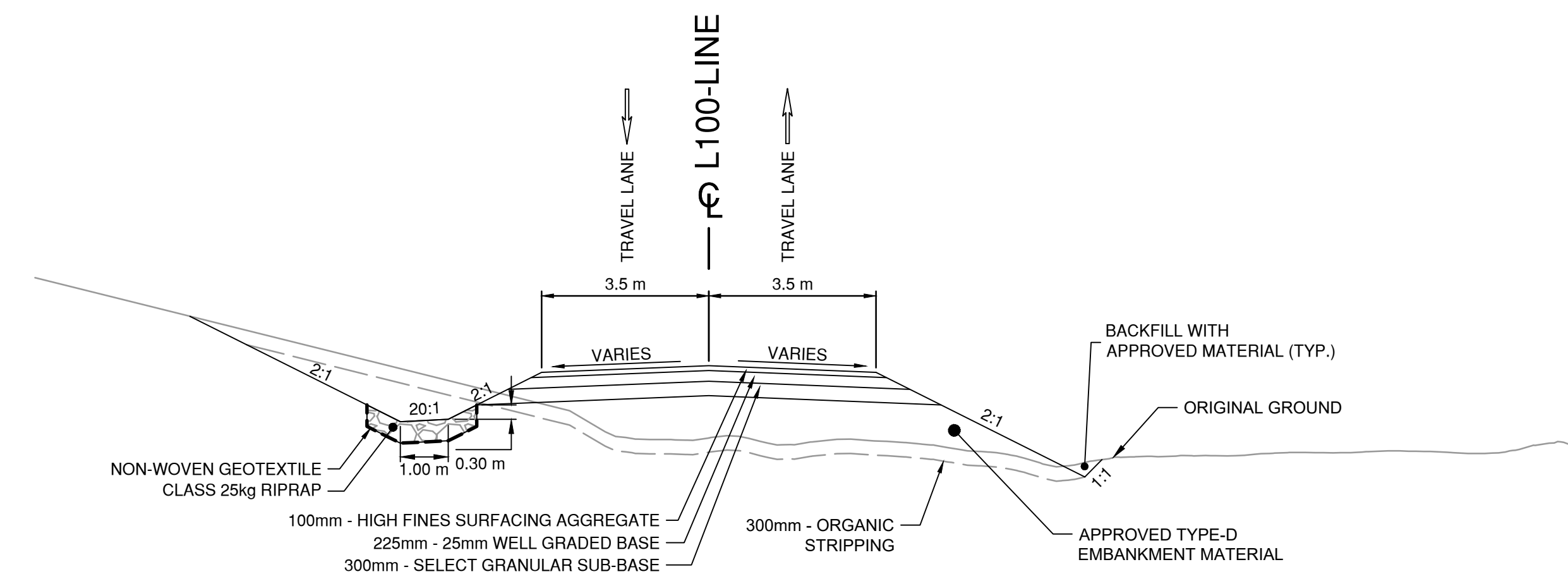
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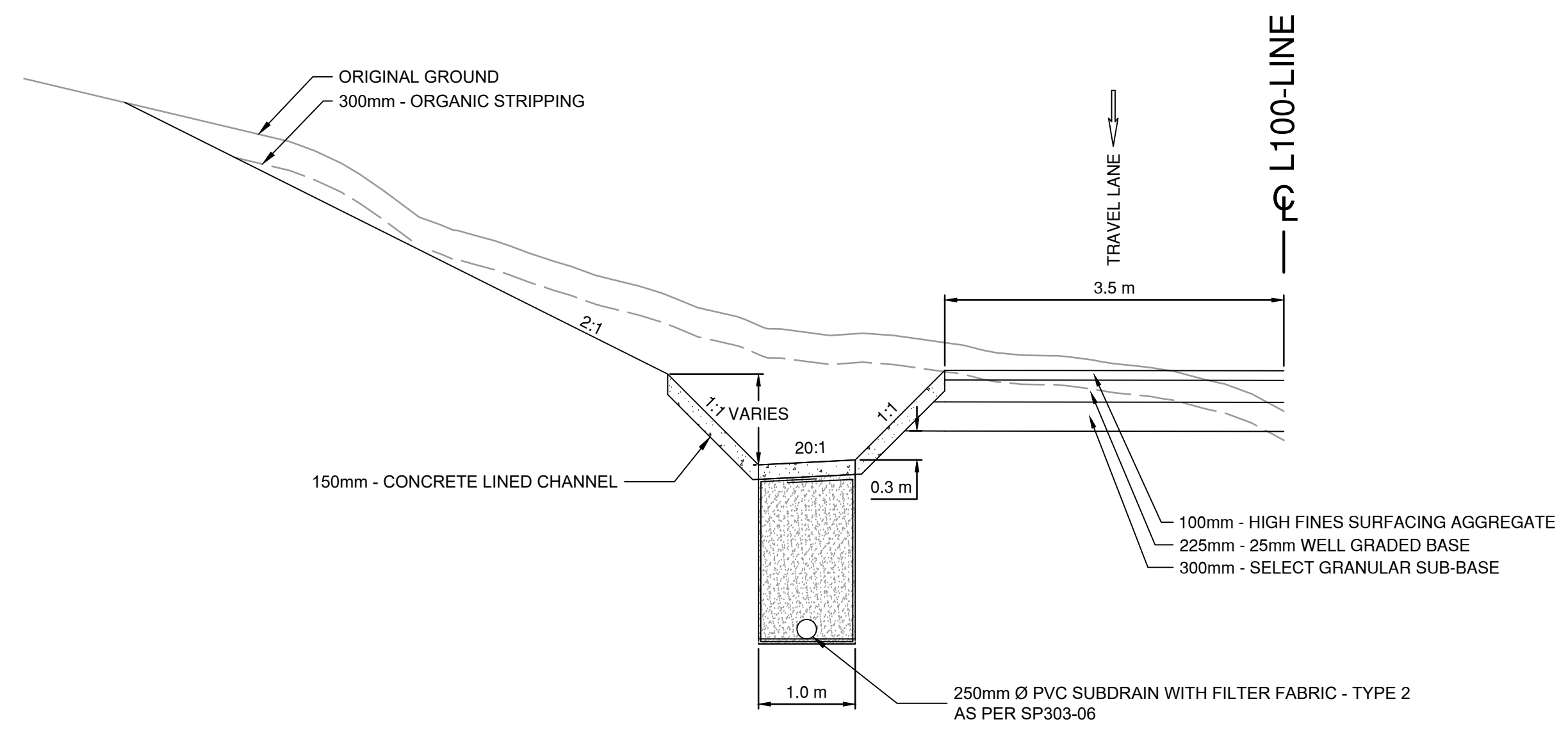
AURUM ROAD (L100-LINE) - TYPICAL SECTION WITH BARRIER



AURUM ROAD (L100-LINE) - TYPICAL SECTION EMBANKMENT TIE-IN



AURUM ROAD (L100-LINE) - TYPICAL SECTION WITHOUT BARRIER





AURUM ROAD (L100-LINE) - TYPICAL SECTION CONCRETE SWALE

STA. 101+00.000 LT TO STA. 102+38.000 LT
 0 0.5 1.50 2.50m

Mar. 23, 2023 08:35 AM P:\2022\22-0953\00 - CAD Files\00-AurumRD\Drawing\Production\001_TypicalSections\300TS-CPT2-AurumRD_22-0953

- FOR PLANS
SEE DWG. R1-1073-101 TO 102
- FOR PROFILES
SEE DWG. R1-1073-201
- FOR TYPICAL SECTIONS
SEE DWG. R1-1073-301

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 The people behind your infrastructure.	R.F. BINNIE & ASSOCIATES LTD. 300 - 4940 Canada Way, Burnaby, BC V5G 4K6 TEL 604 420 1721 BINNIE.com	 BRITISH COLUMBIA	MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE SOUTH COAST REGION HIGHWAY ENGINEERING AND GEOMATICS																								
SCALE $\frac{0}{1} \frac{1}{100} \frac{5}{m}$ CAD FILENAME 300TS-OPT2-AURUMRD_22-0953.DWG UNLESS OTHERWISE SHOWN DATE 2023-03-23 FILE NUMBER 22-0953		TYPICAL SECTIONS AURUM ROAD WASHOUT OPTION 2 - ROAD REALIGNMENT																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>REV</th> <th>DATE</th> <th>REVISIONS</th> <th>SIGNATURE</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>		REV	DATE	REVISIONS	SIGNATURE																					<div style="border: 2px solid black; padding: 5px; display: inline-block;">DRAFT</div>	DESIGNED _____ M.C. DATE MAR. 2023 QUALITY CONTROL _____ M.C. DATE MAR. 2023 QUALITY ASSURANCE _____ M.C. DATE MAR. 2023 DRAWN _____ J.T. DATE MAR. 2023
REV	DATE	REVISIONS	SIGNATURE																								
		MICHAEL CARREIRA ENGINEER OF RECORD DATE _____	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>PROJECT NUMBER</th> <th>REG</th> <th>DRAWING NUMBER</th> <th>REV</th> </tr> <tr> <td style="text-align: center;">14137</td> <td style="text-align: center;">1</td> <td style="text-align: center;">R1-1073-301</td> <td> </td> </tr> </table>	PROJECT NUMBER	REG	DRAWING NUMBER	REV	14137	1	R1-1073-301																	
PROJECT NUMBER	REG	DRAWING NUMBER	REV																								
14137	1	R1-1073-301																									



Ministry of
Transportation
and Infrastructure

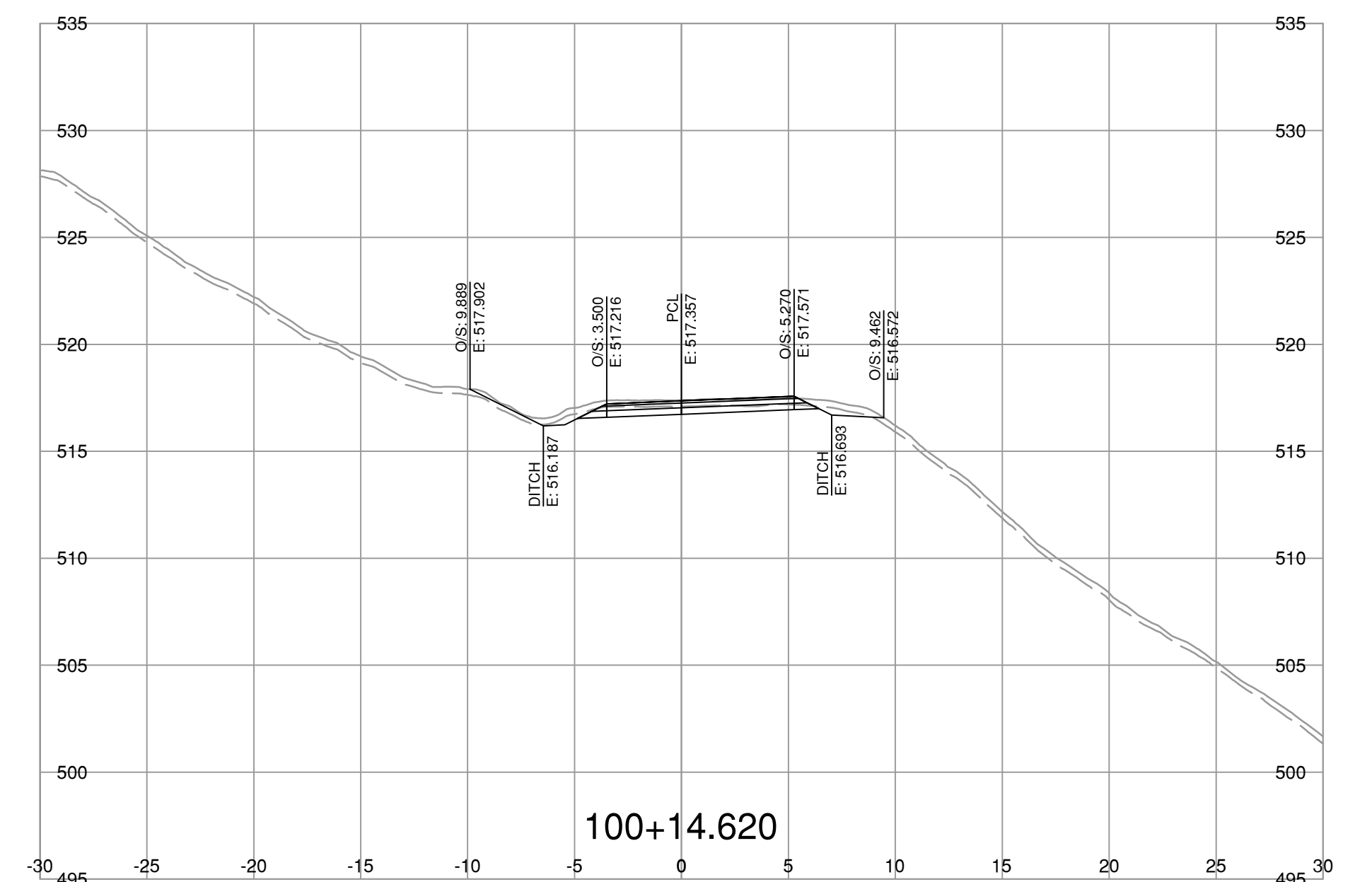
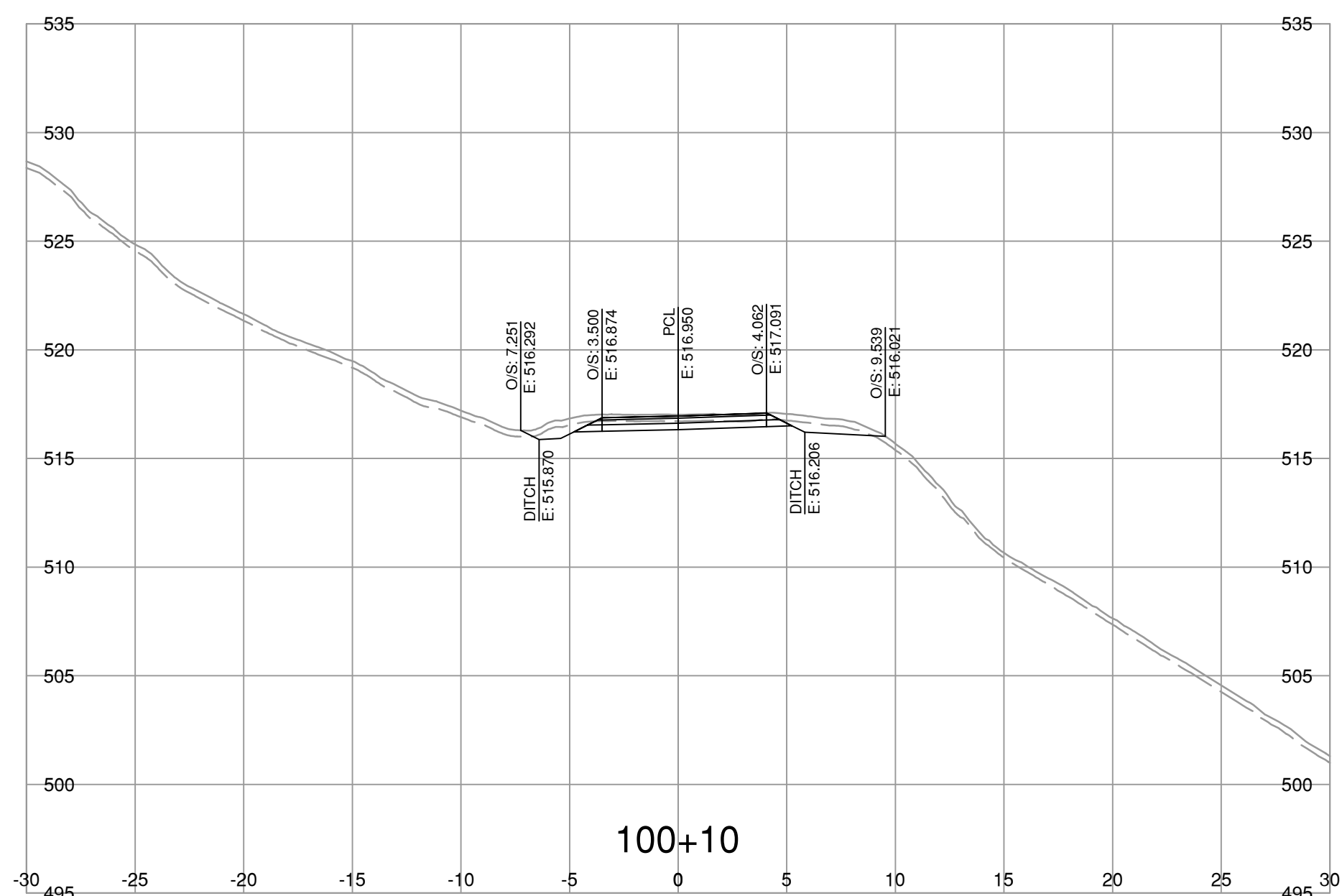
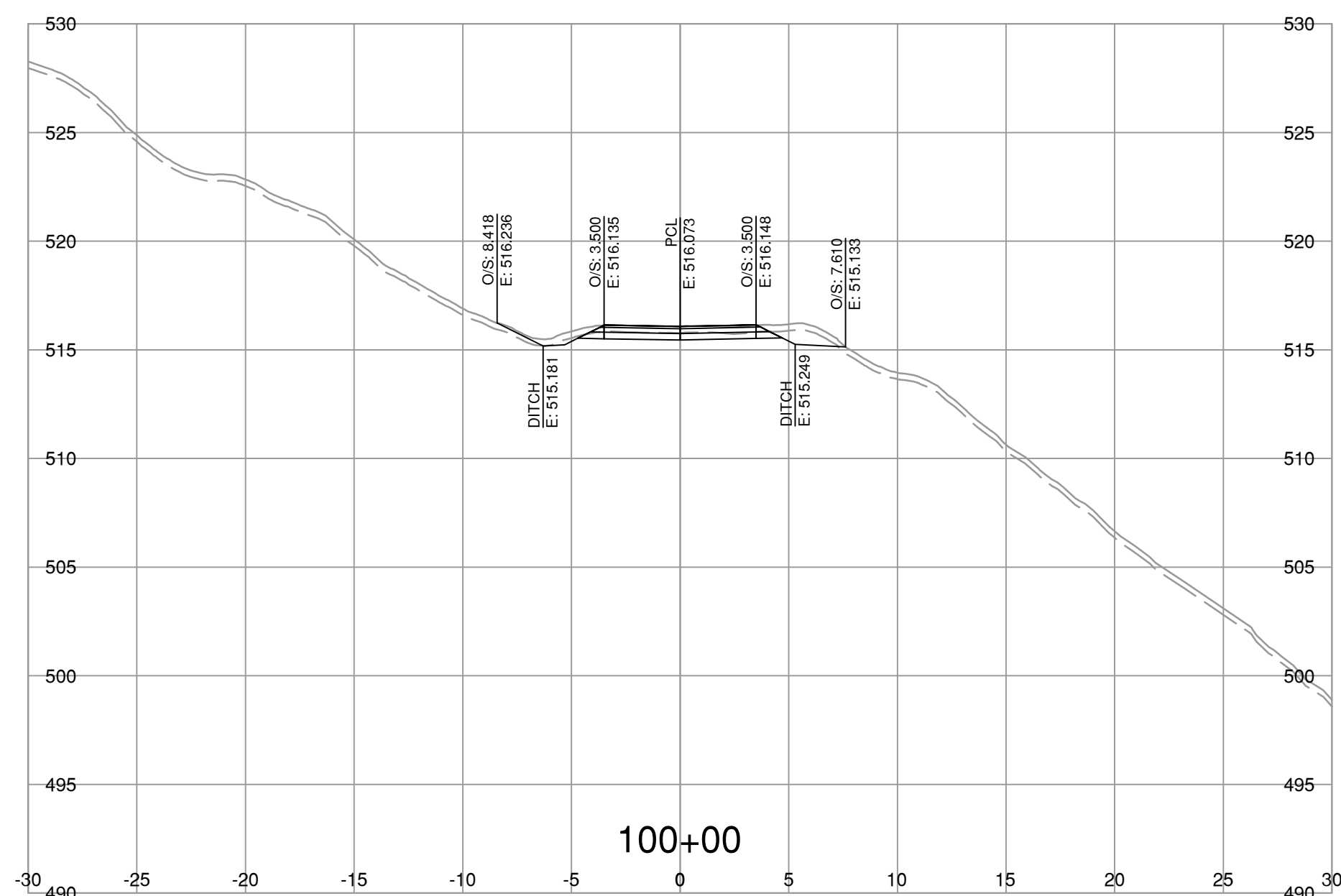
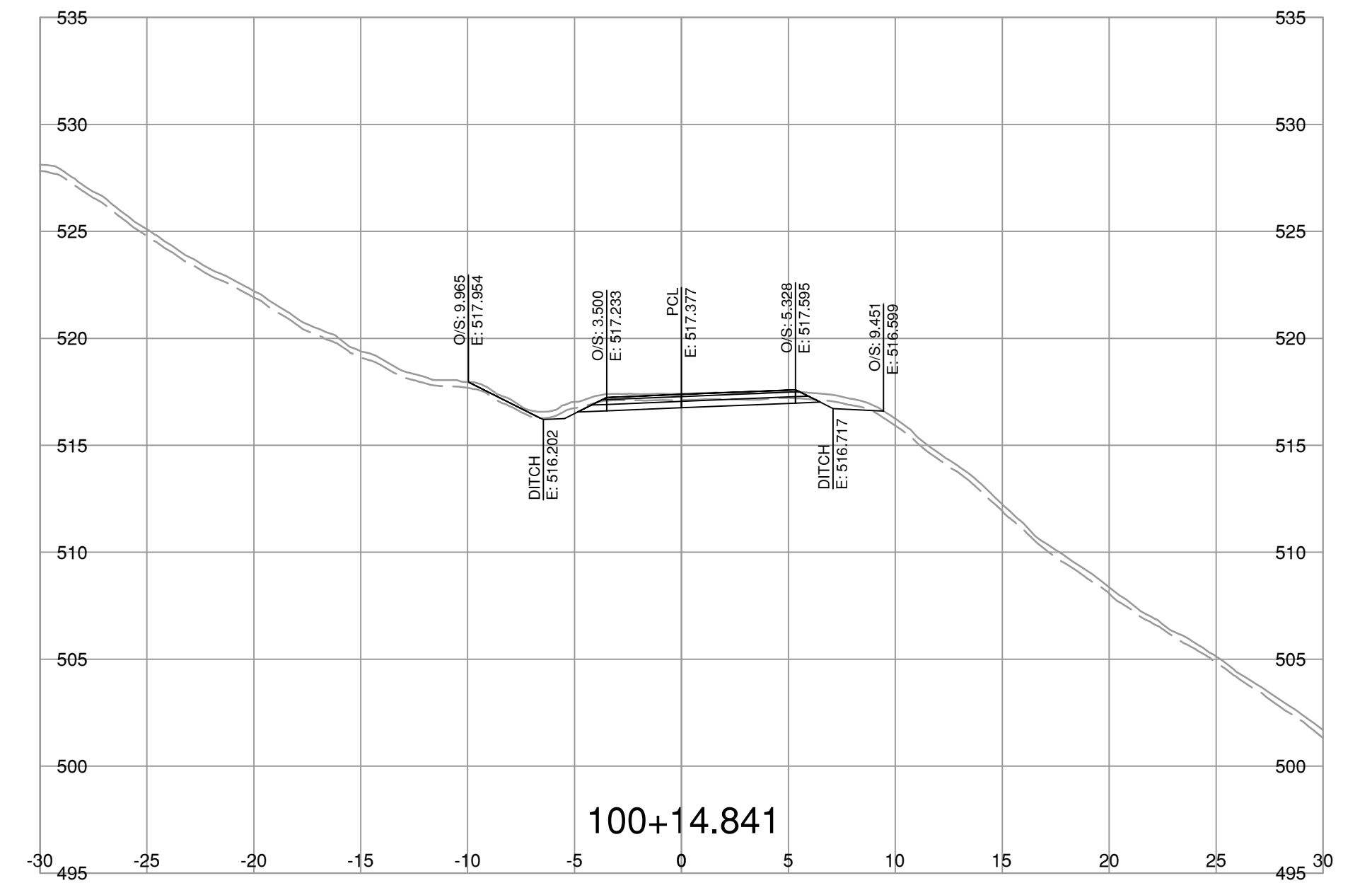
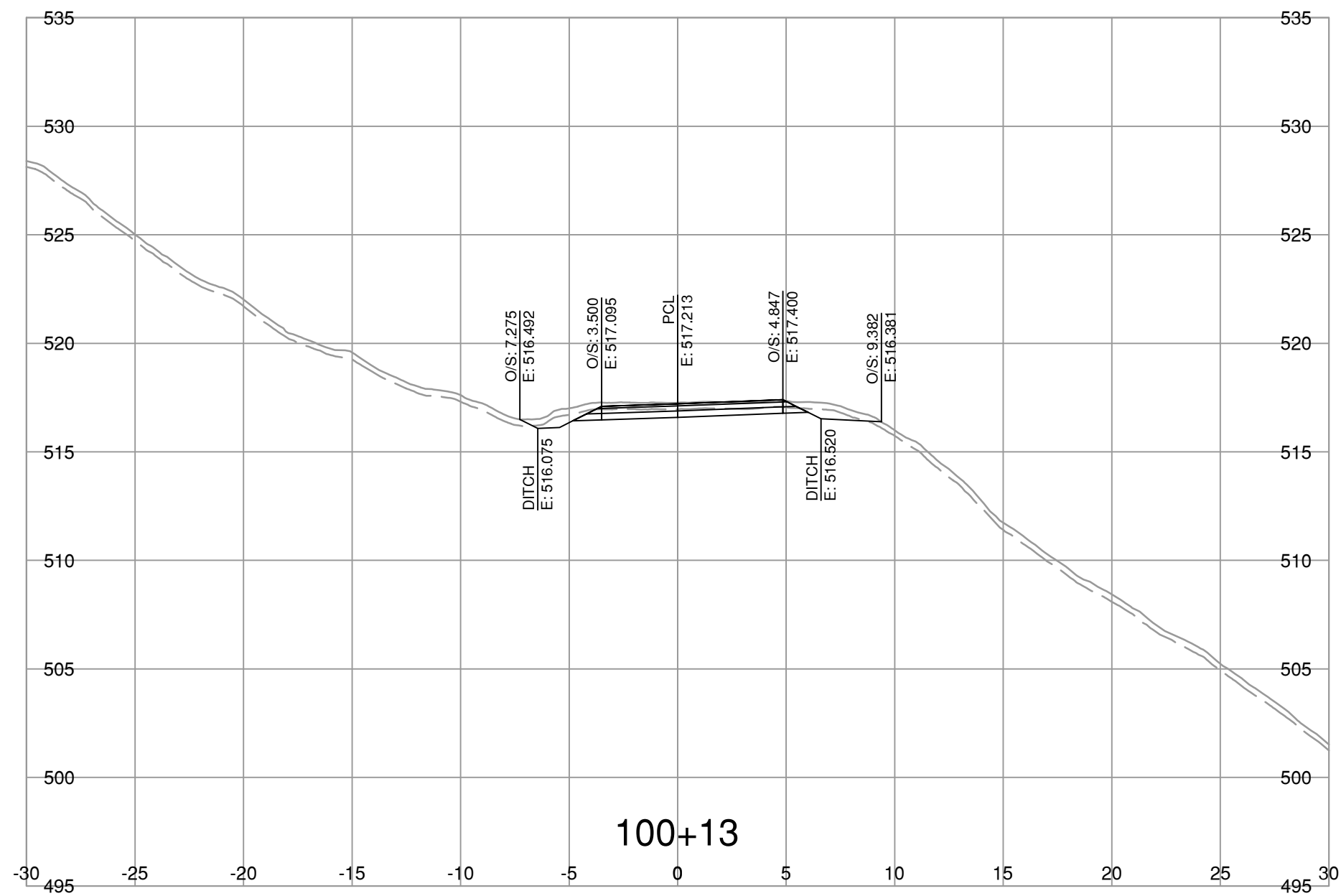
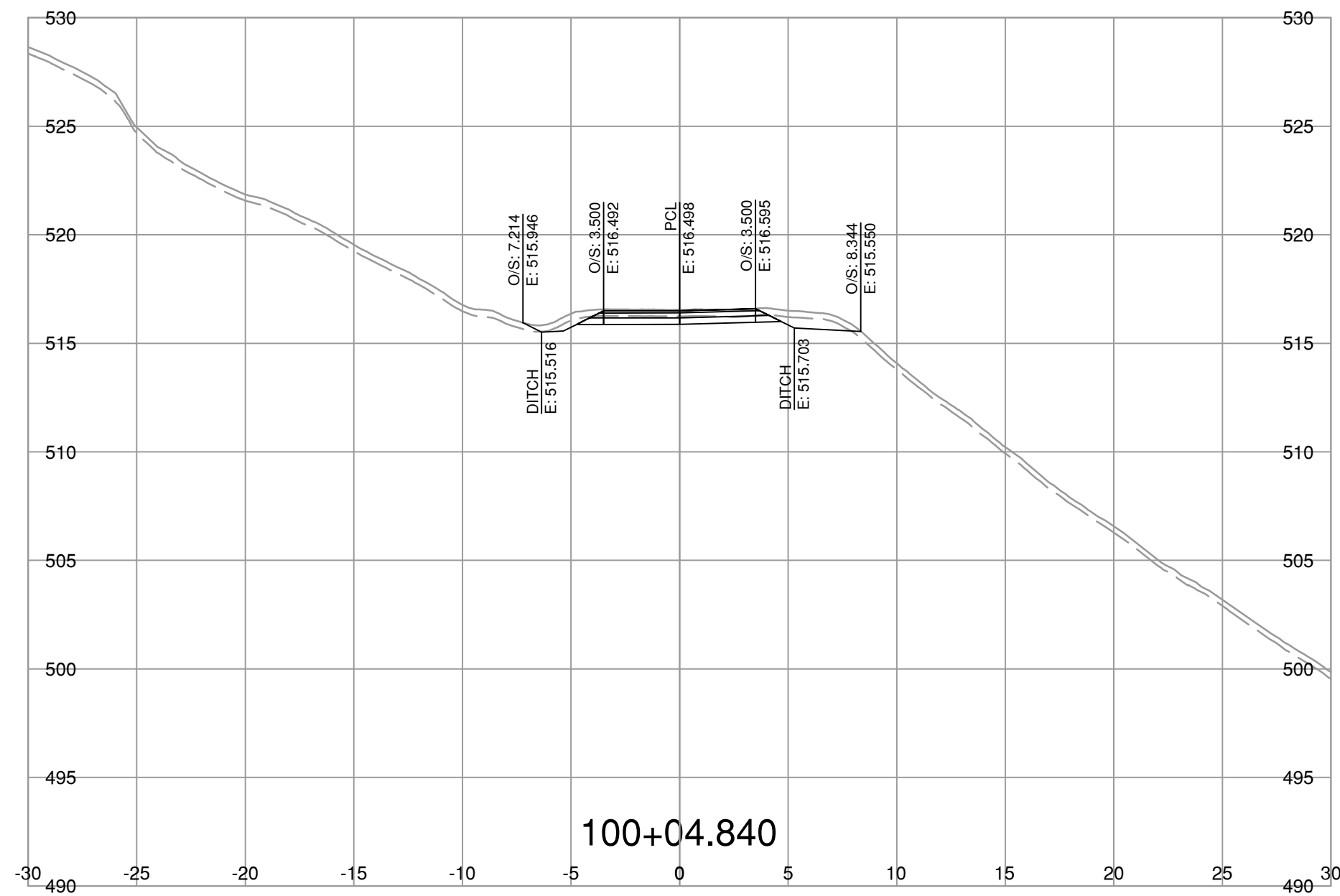
PROJECT NO. 14137

CROSS SECTIONS SET

AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

FOR DISCUSSION ONLY - MAR. 31, 2023

IAN PILKINGTON, CHIEF ENGINEER



NOTE: STRIPPING REMOVAL APPLIES ONLY TO THE AREA BETWEEN SLOPE STAKE LINES (TOES & TOP OF CUT) OF PROPOSED ROADWAY TEMPLATE

FOR REFERENCE ONLY

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FOR DISCUSSION ONLY - MAR. 31, 2023

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SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

L100-LINE CROSS SECTIONS
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

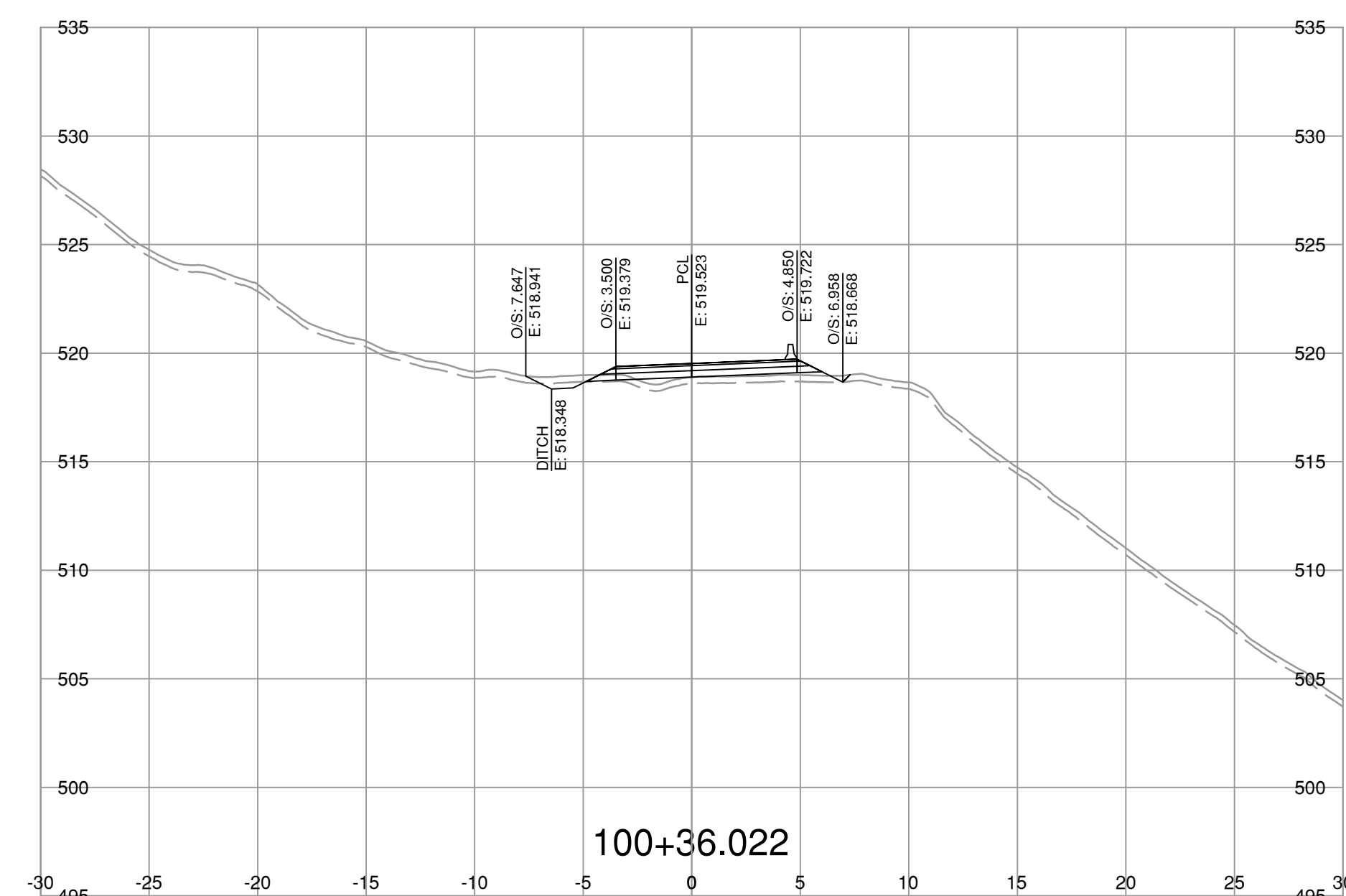
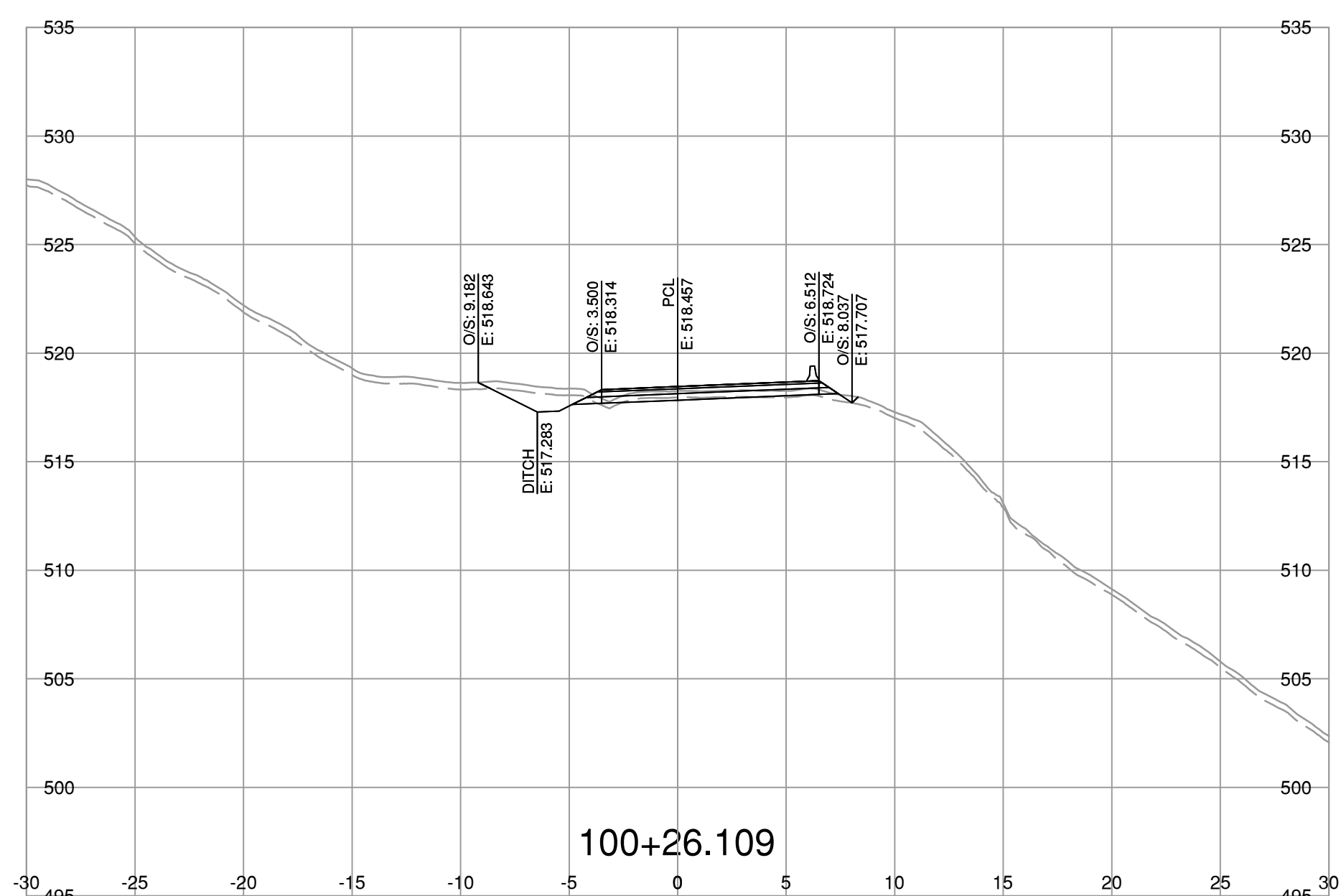
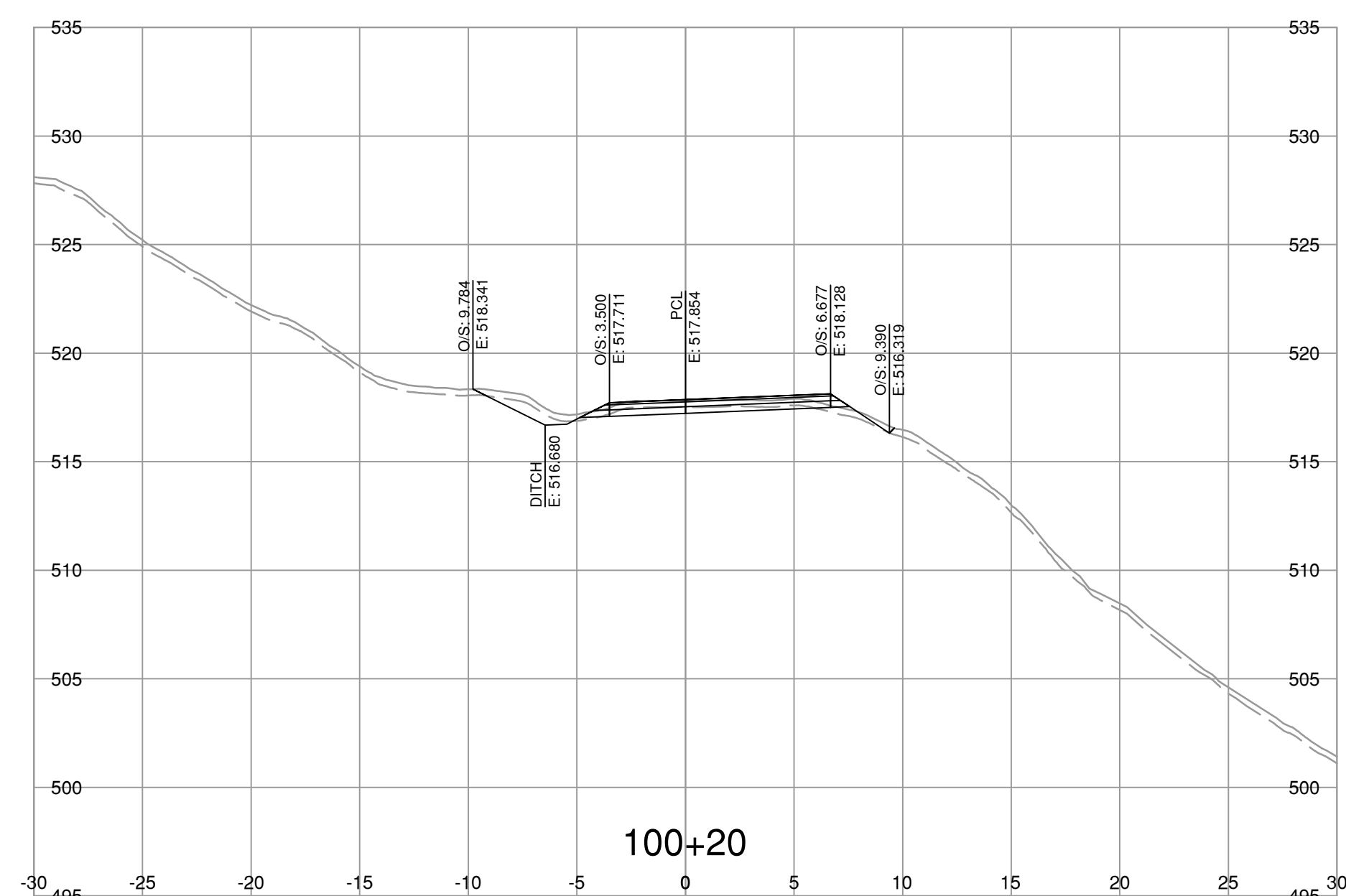
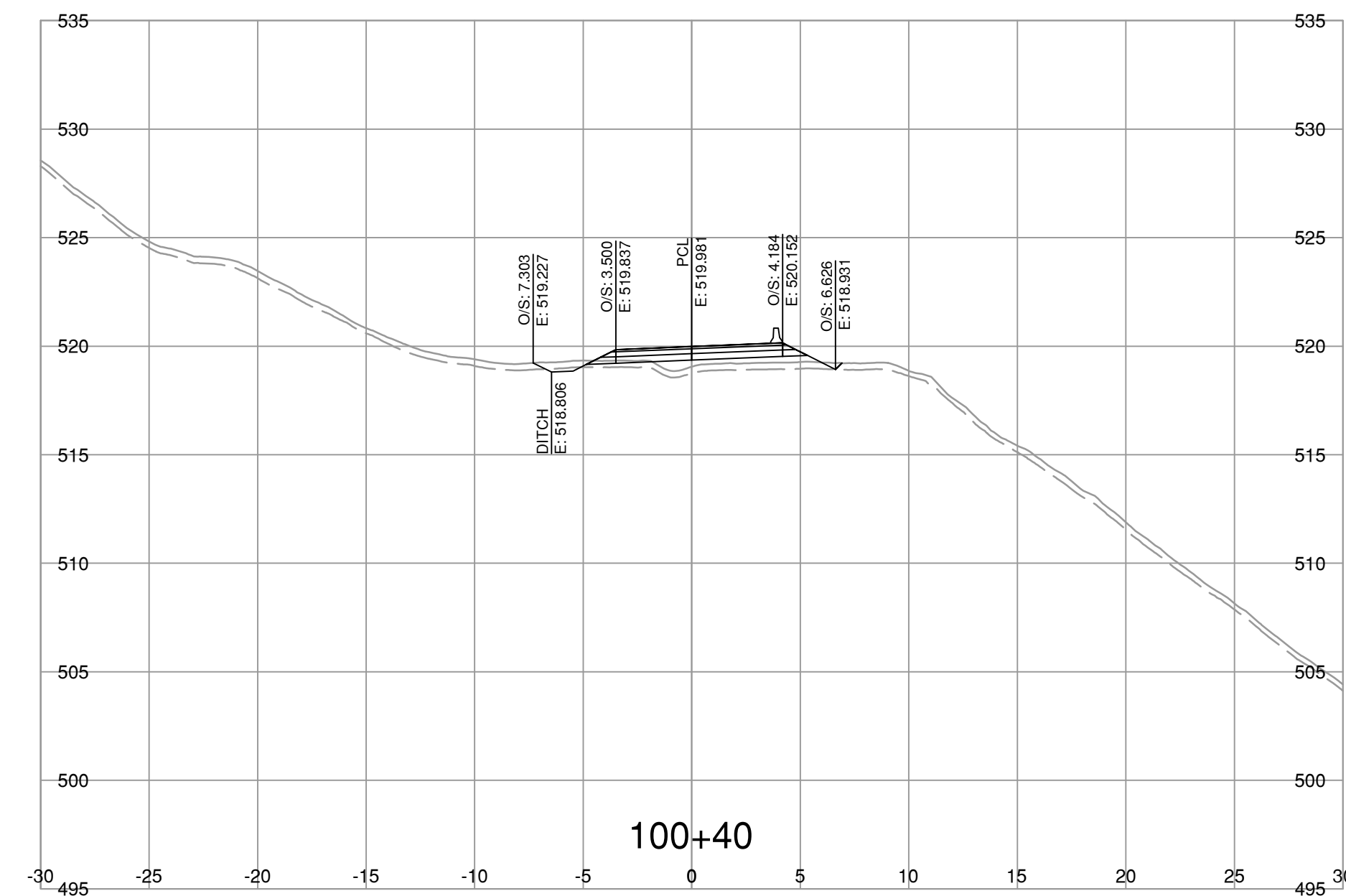
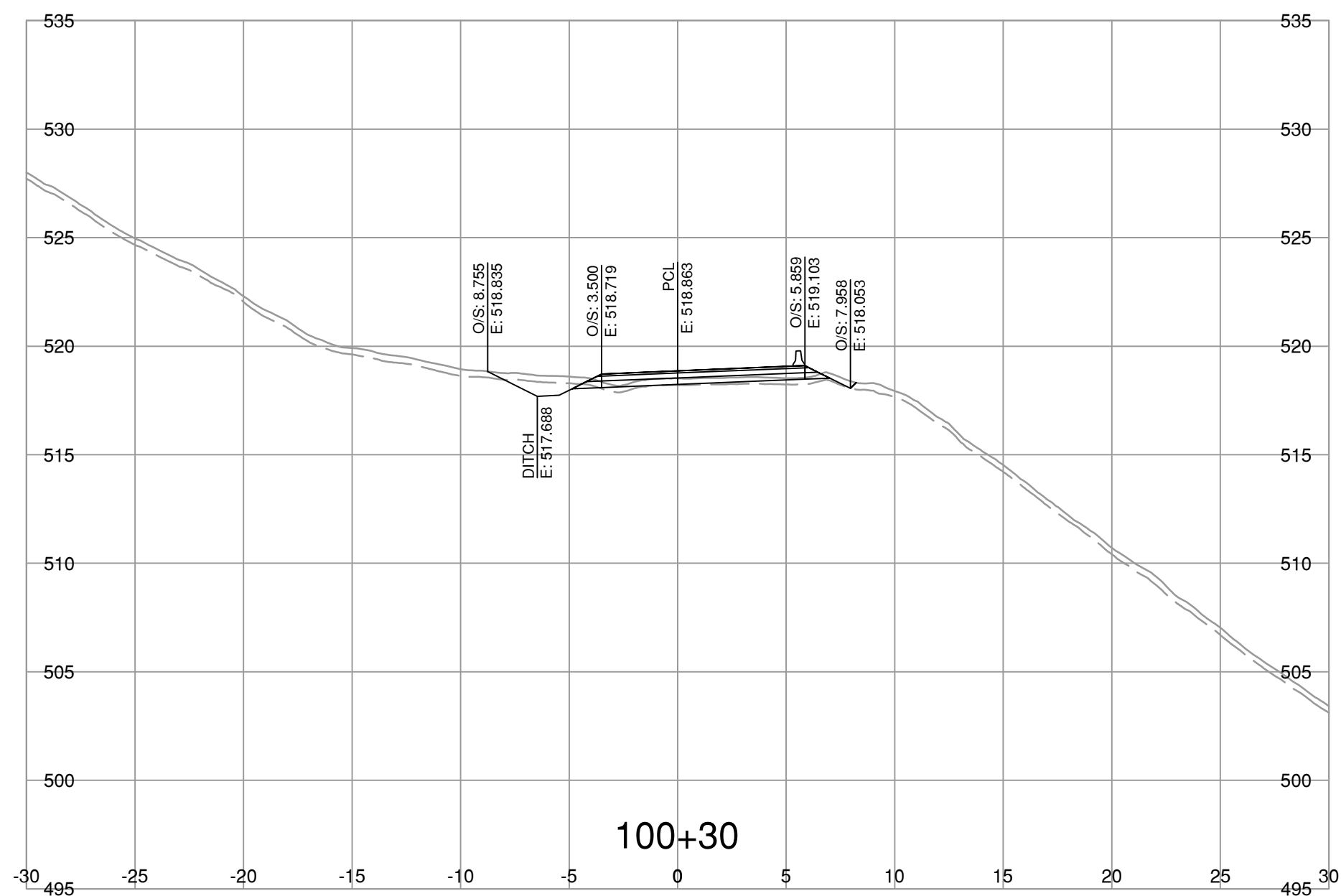
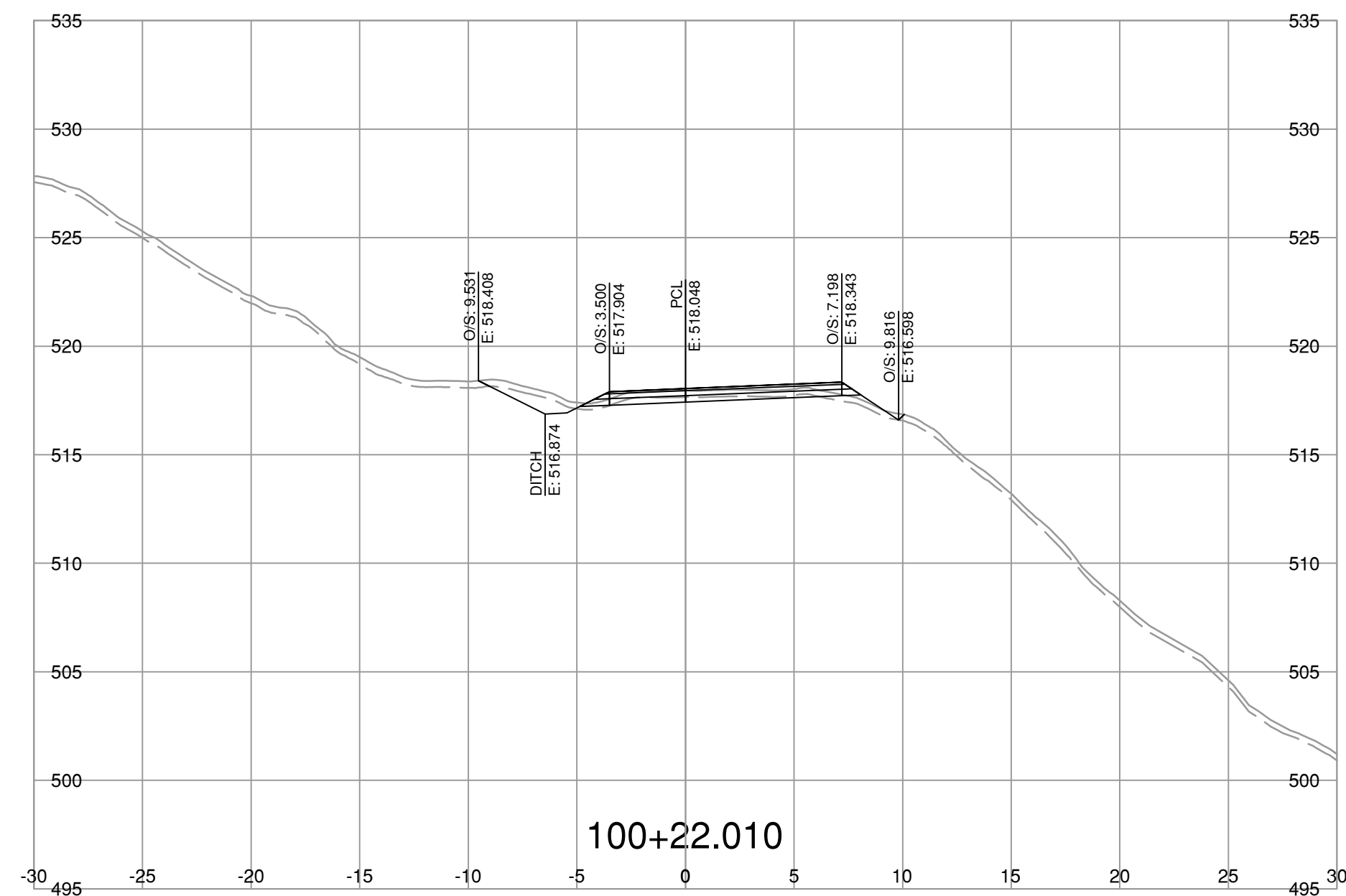
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CAD FILENAME: SECT-4-100AS.DWG
DATE: 2023-03-23
FILE NUMBER: 22-0953

REV	DATE	REVISIONS	SIGNATURE

DESIGNED	_____	M.C.	DATE	MAR. 2023
QUALITY CONTROL	_____	M.C.	DATE	MAR. 2023
QUALITY ASSURANCE	_____	M.C.	DATE	MAR. 2023
DRAWN	_____	J.T.	DATE	MAR. 2023
PROJECT NUMBER	14137	REG	1	DRAWING NUMBER
				R1-1073-L100XS-1

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NOTE: STRIPPING REMOVAL APPLIES ONLY TO THE AREA BETWEEN SLOPE STAKE LINES (TOES & TOP OF CUT) OF PROPOSED ROADWAY TEMPLATE

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HIGHWAY ENGINEERING AND GEOMATICS

L100-LINE CROSS SECTIONS
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

SCALE 0 2 1:250 12m

REV DATE REVISIONS SIGNATURE

DESIGNED _____ M.C. DATE MAR. 2023

QUALITY CONTROL _____ M.C. DATE MAR. 2023

QUALITY ASSURANCE _____ M.C. DATE MAR. 2023

DRAWN _____ J.T. DATE MAR. 2023

PROJECT NUMBER 14137

REG 1

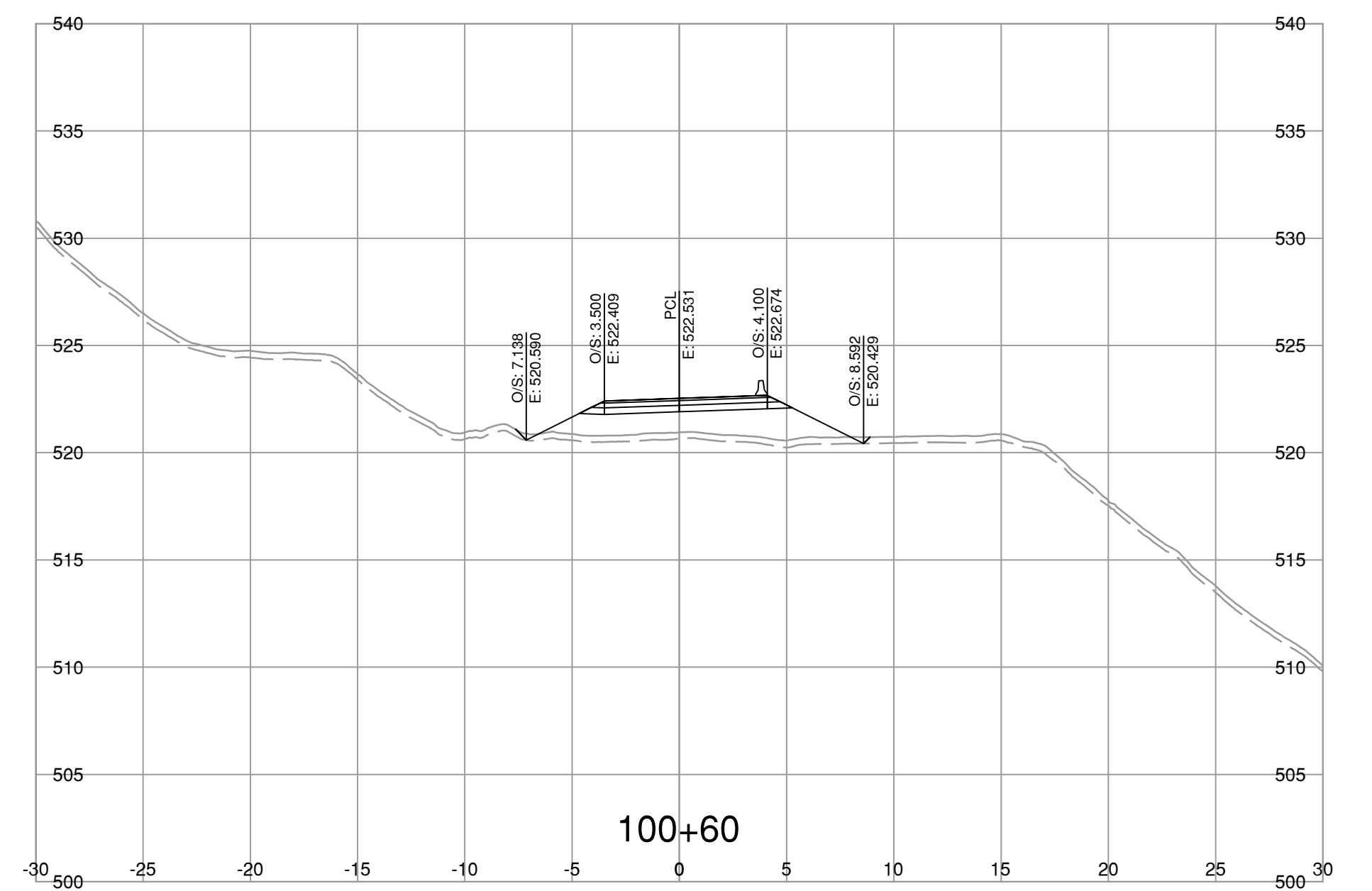
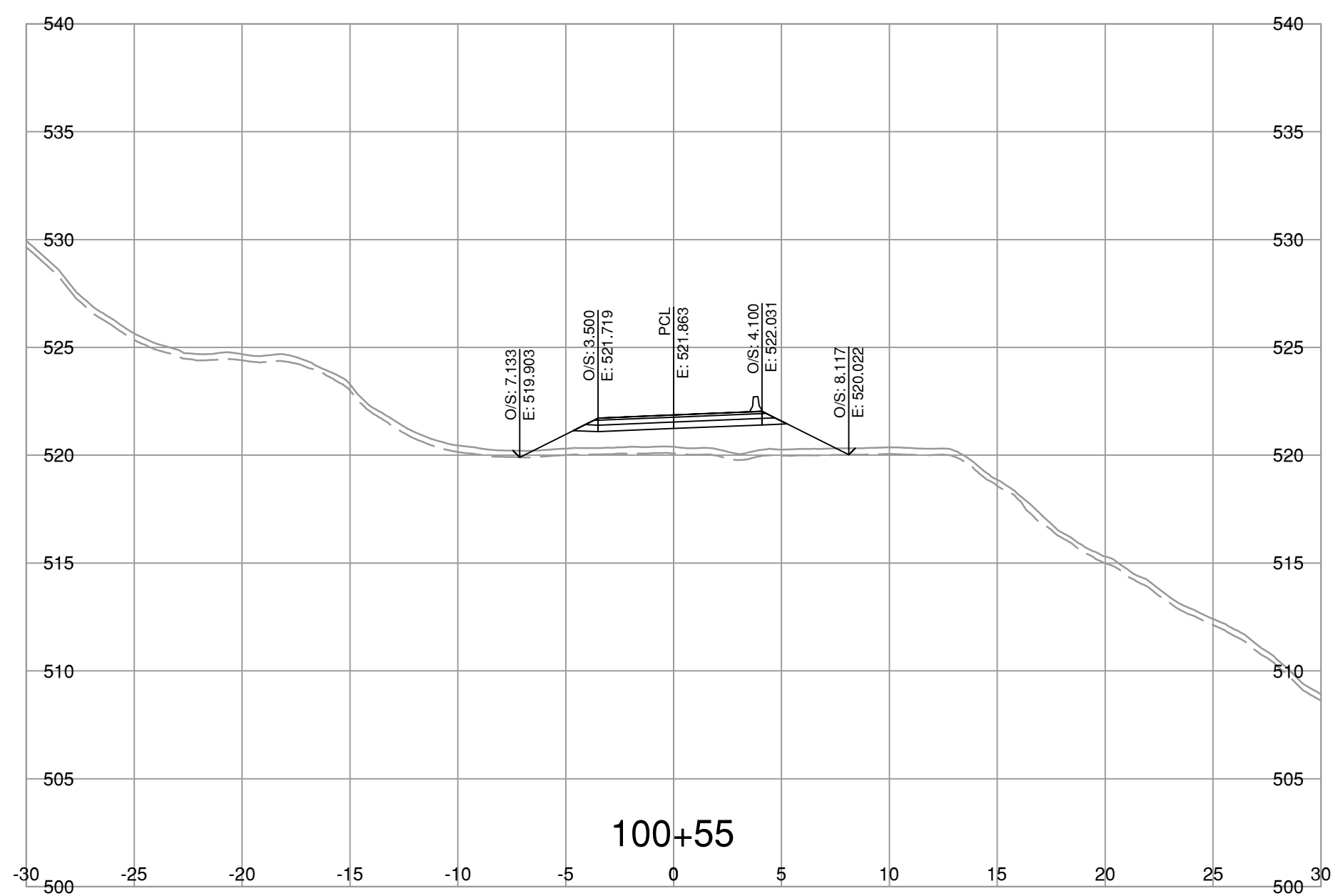
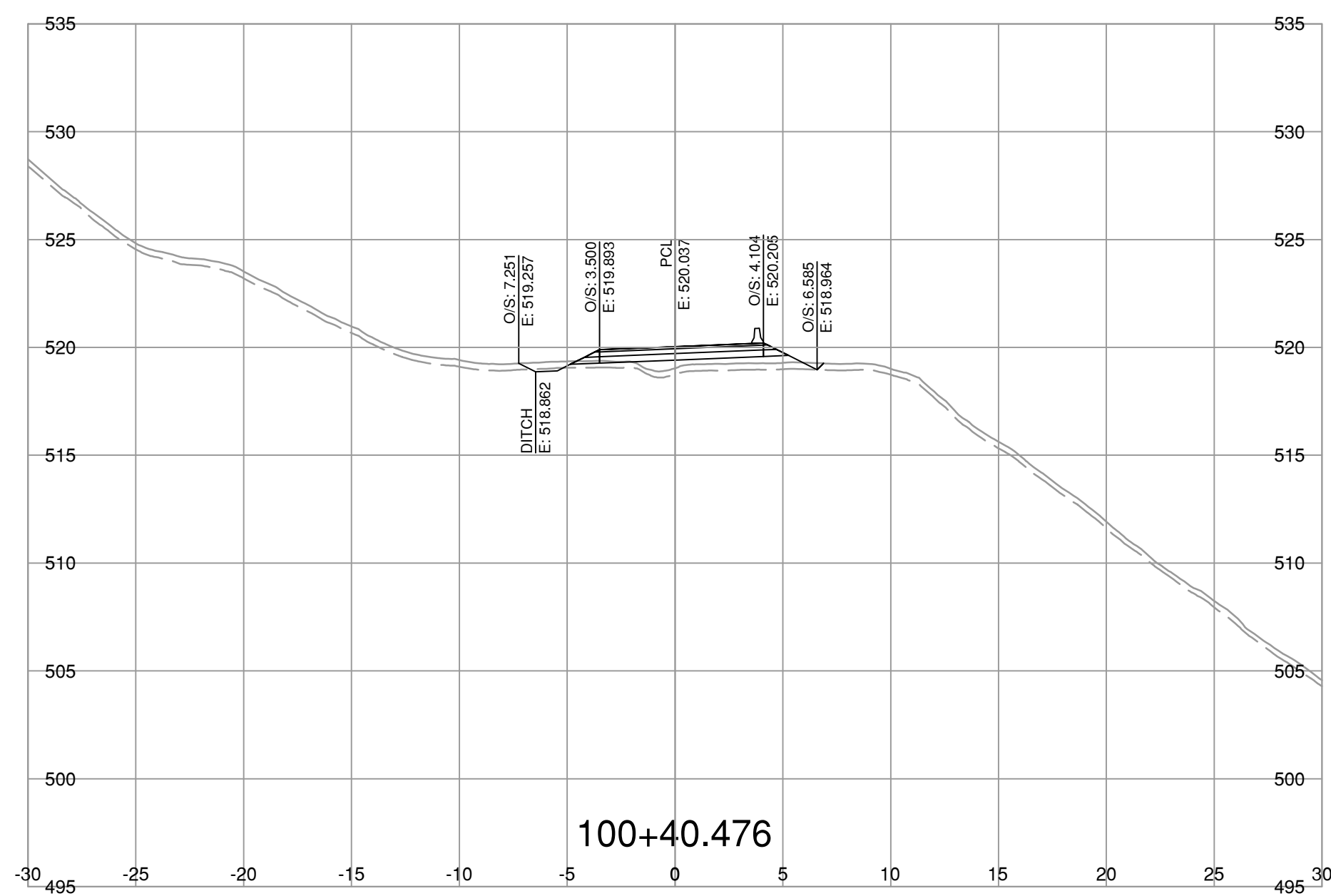
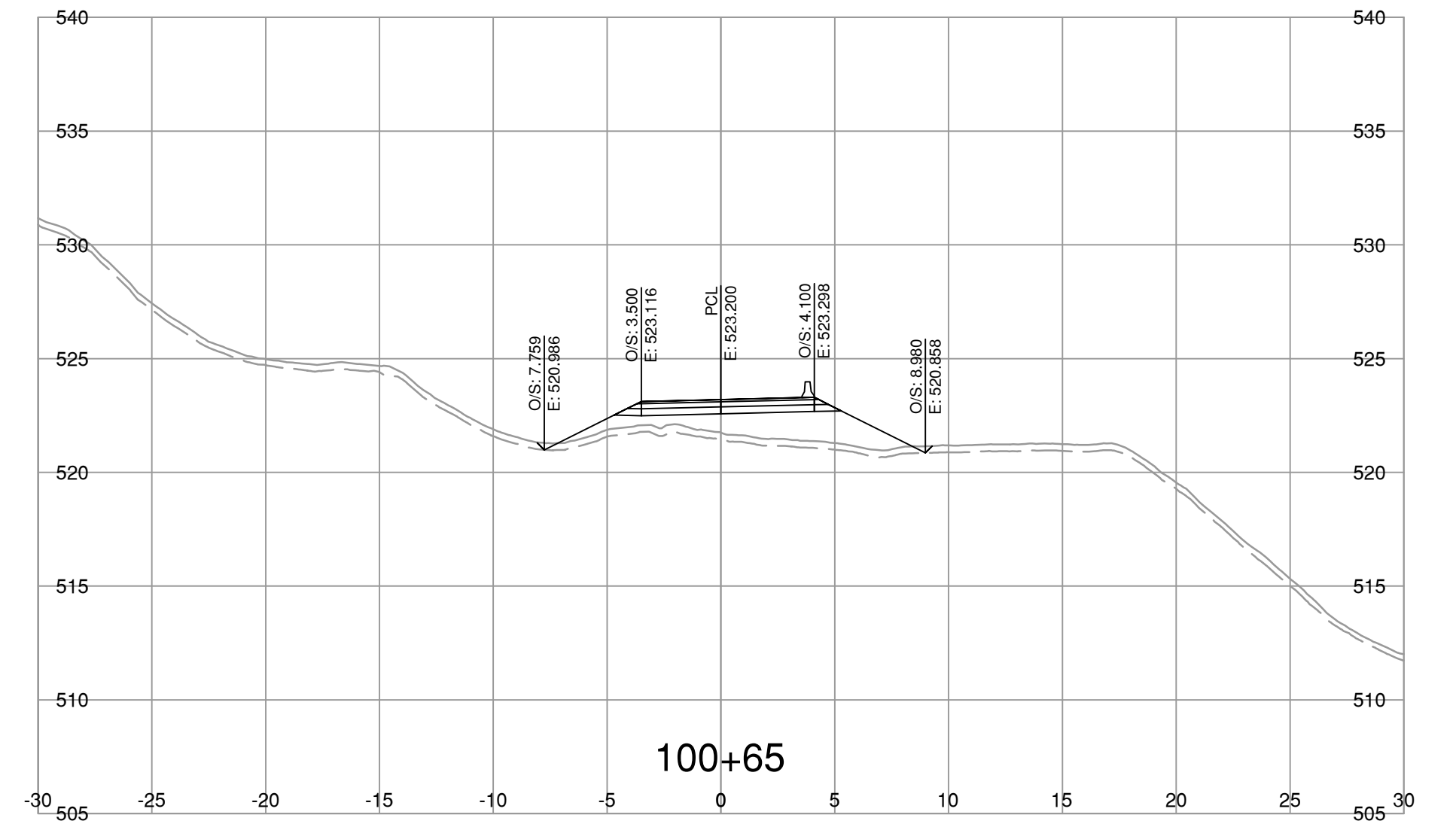
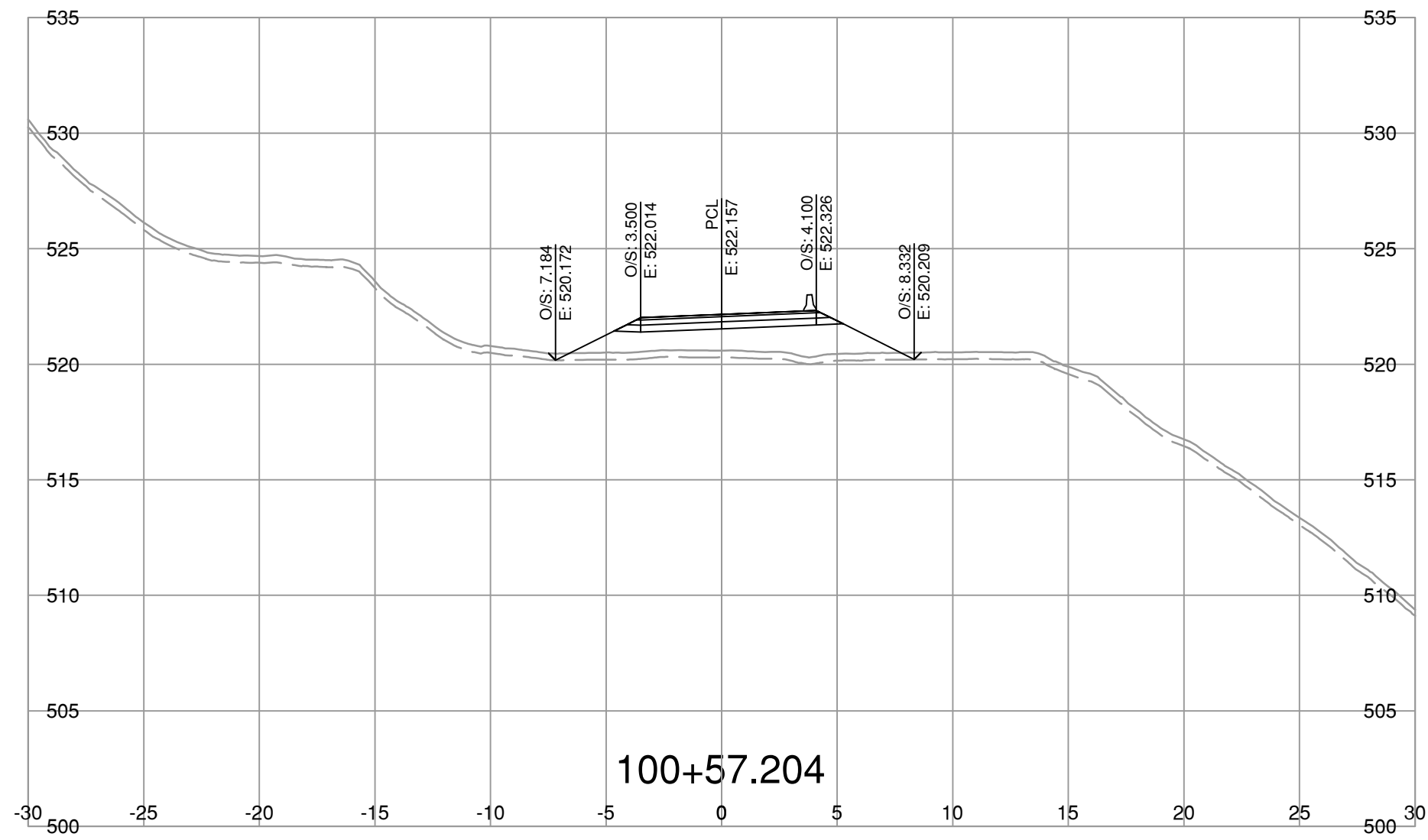
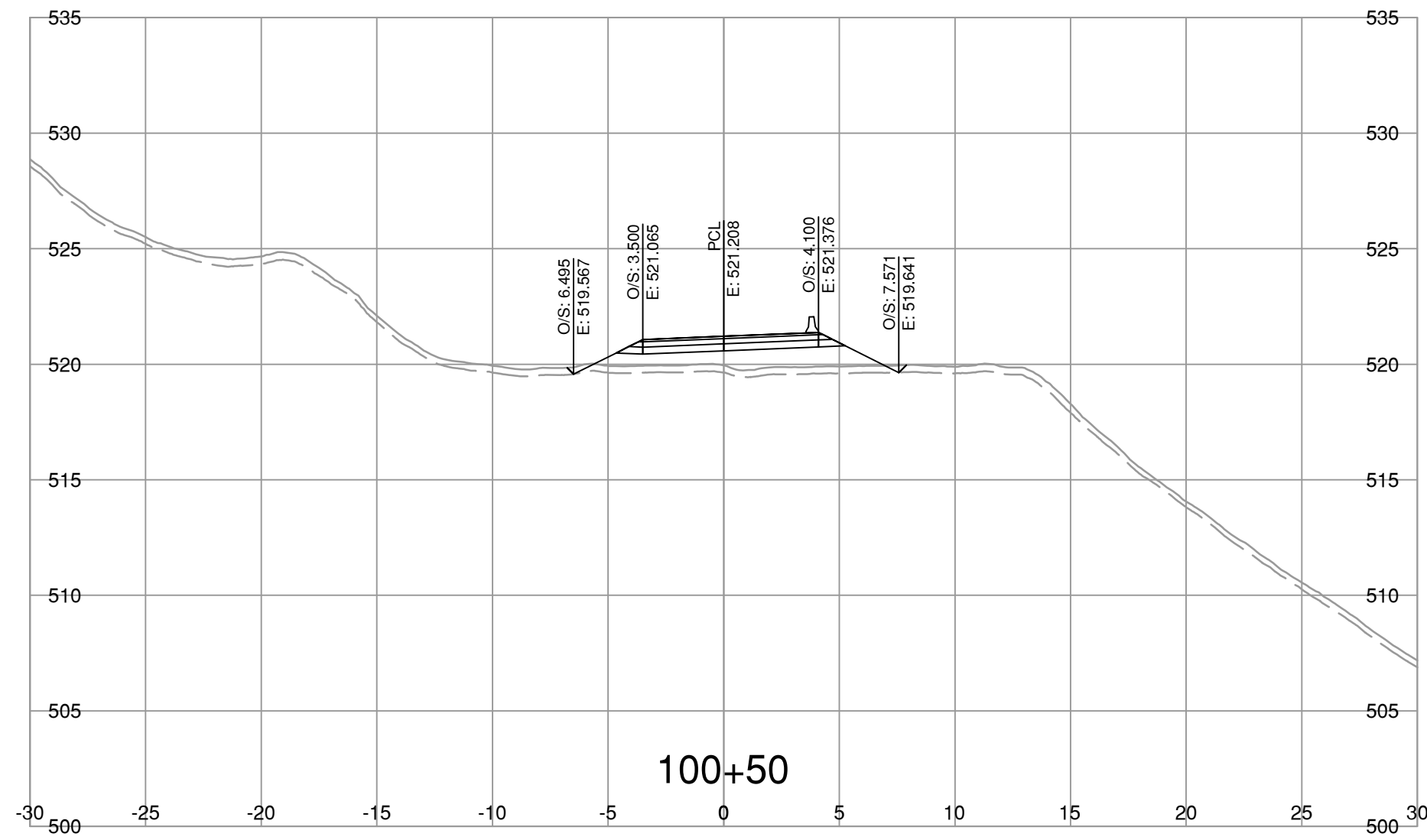
DRAWING NUMBER R1-1073-L100XS-2

REV

CAD FILENAME SECT-4-100AS.DWG

DATE 2023-03-23

FILE NUMBER 22-0953



NOTE: STRIPPING REMOVAL APPLIES ONLY TO THE AREA BETWEEN SLOPE STAKE LINES (TOES & TOP OF CUT) OF PROPOSED ROADWAY TEMPLATE

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HIGHWAY ENGINEERING AND GEOMATICS

L100-LINE CROSS SECTIONS
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

REV	DATE	REVISIONS	SIGNATURE

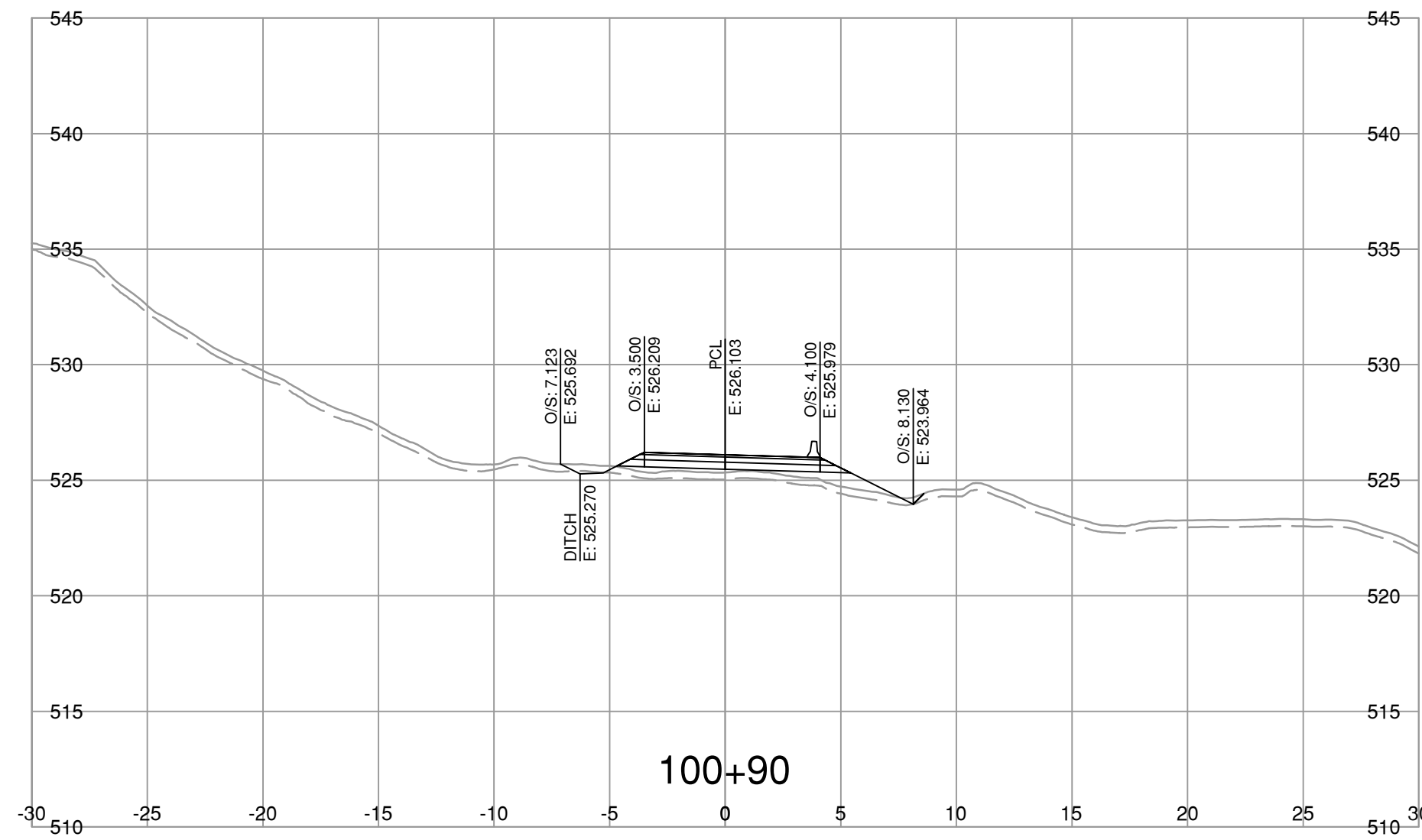
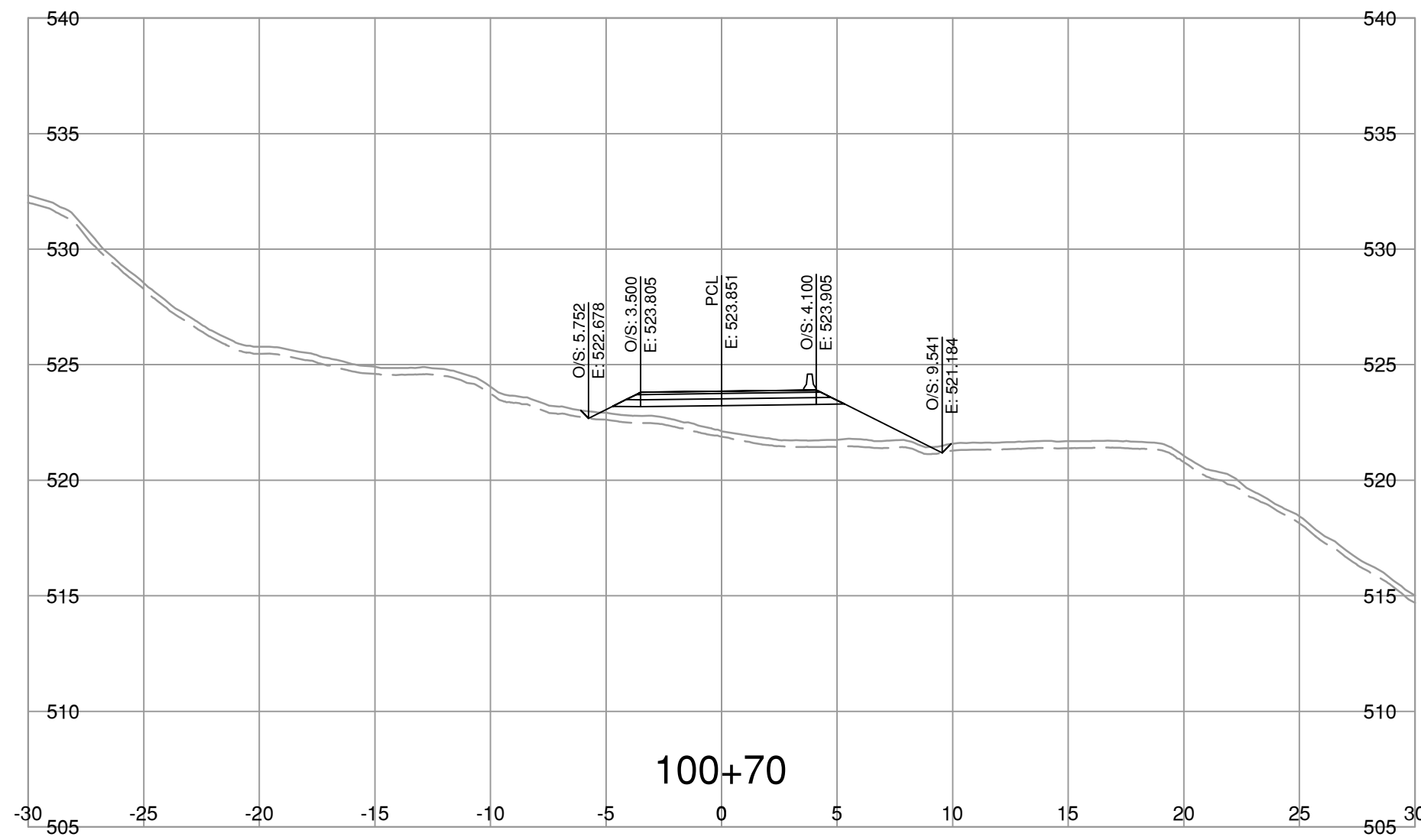
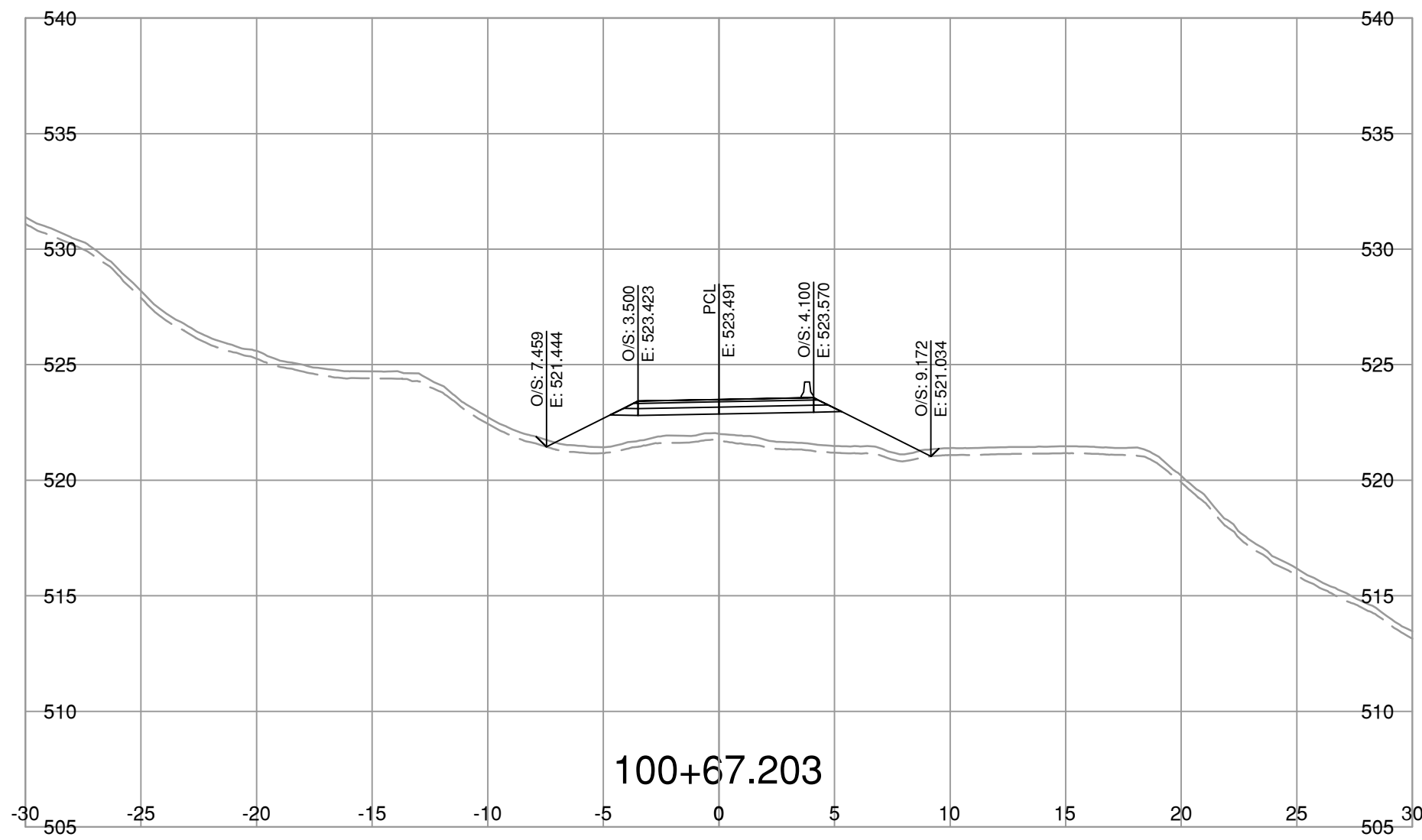
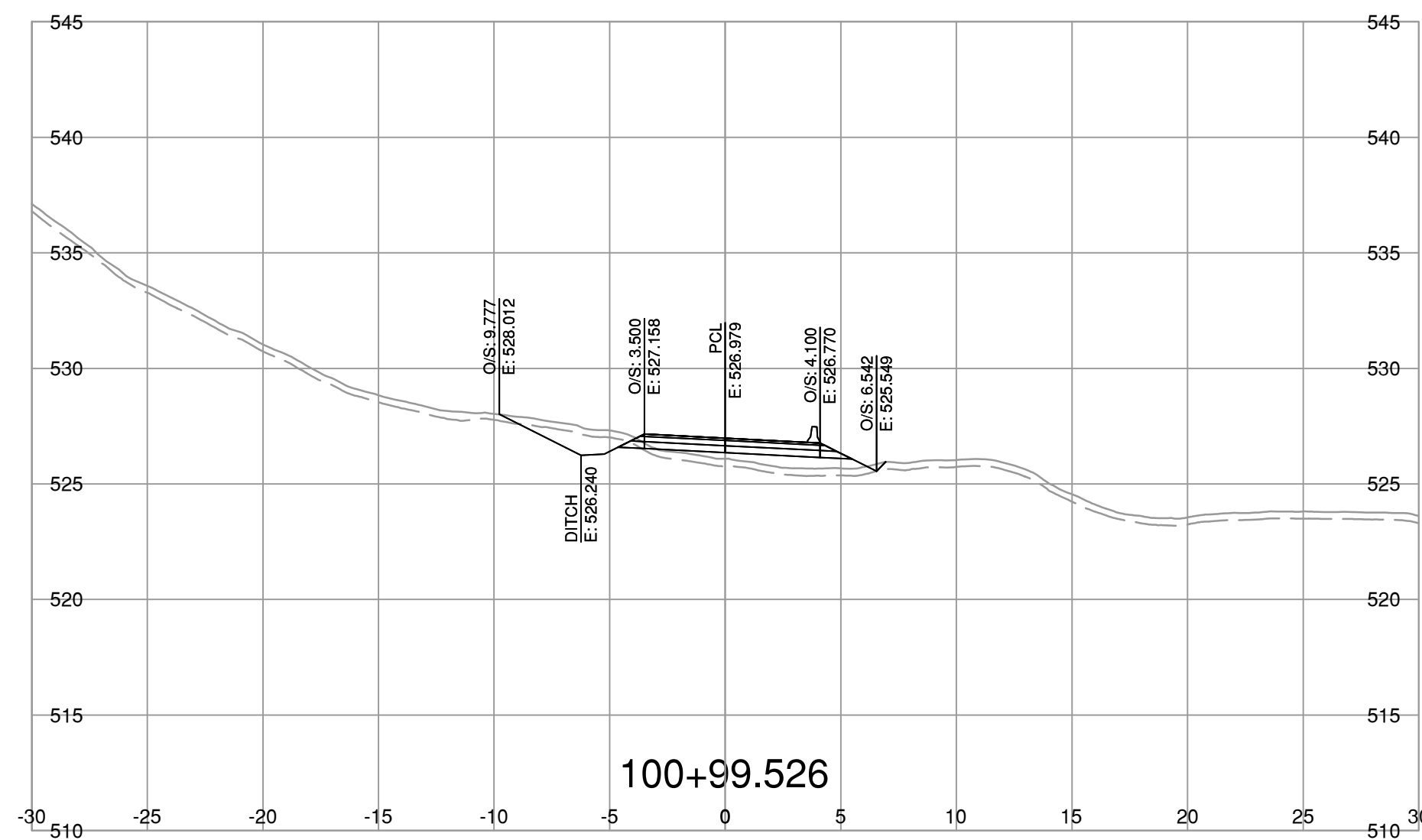
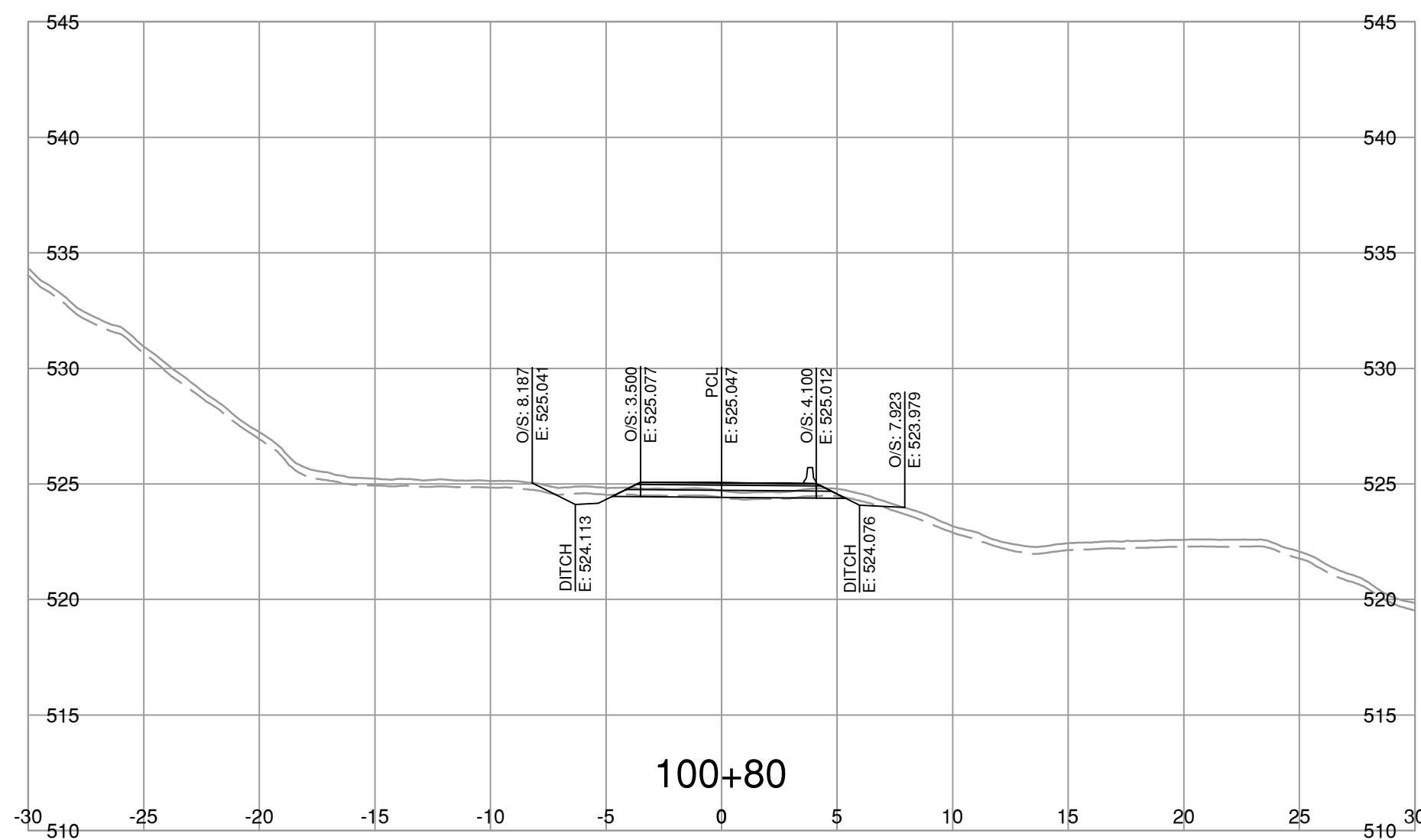
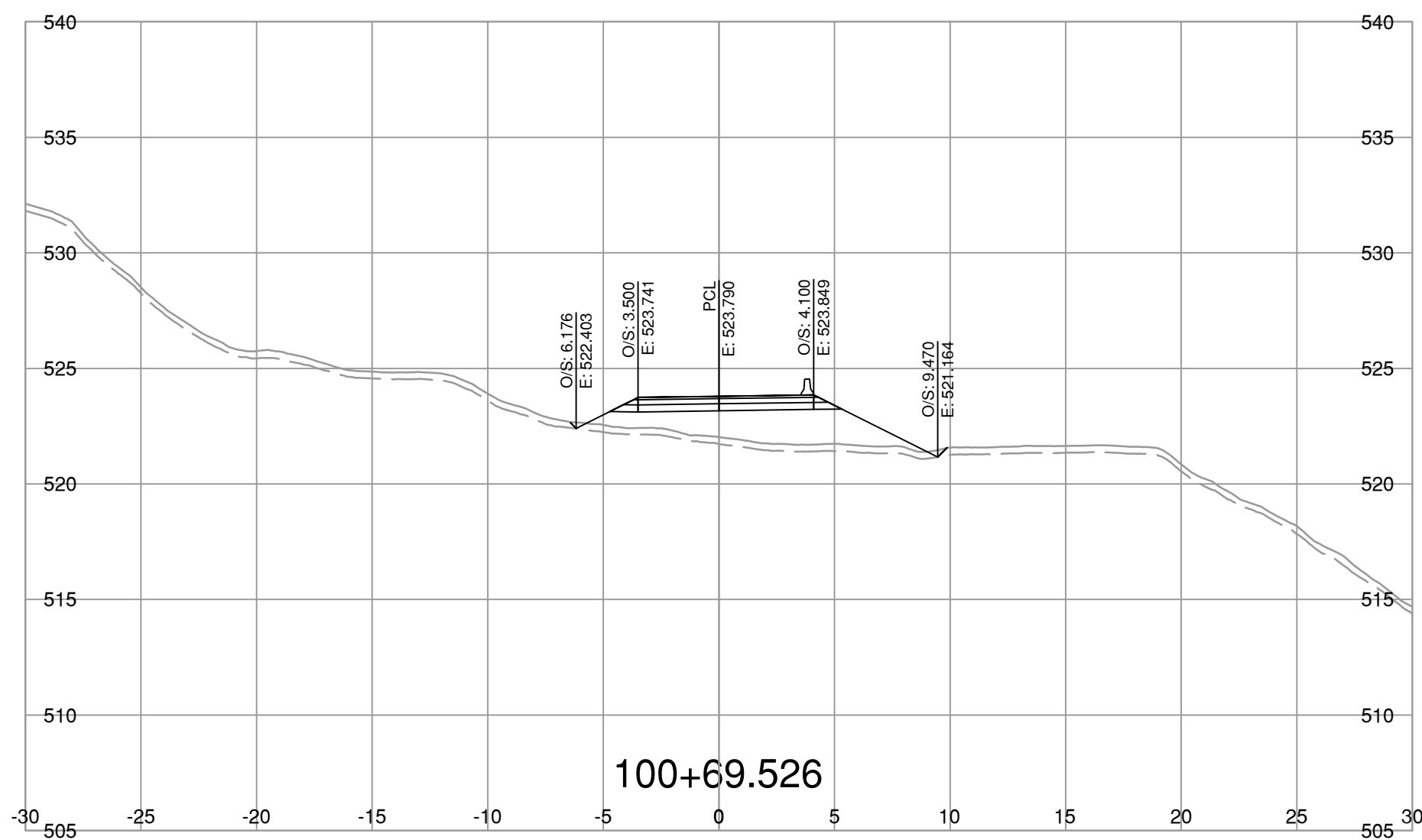
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DESIGNED: _____ M.C. DATE: MAR_2023
QUALITY CONTROL: _____ M.C. DATE: MAR_2023
QUALITY ASSURANCE: _____ M.C. DATE: MAR_2023
DRAWN: _____ J.T. DATE: MAR_2023

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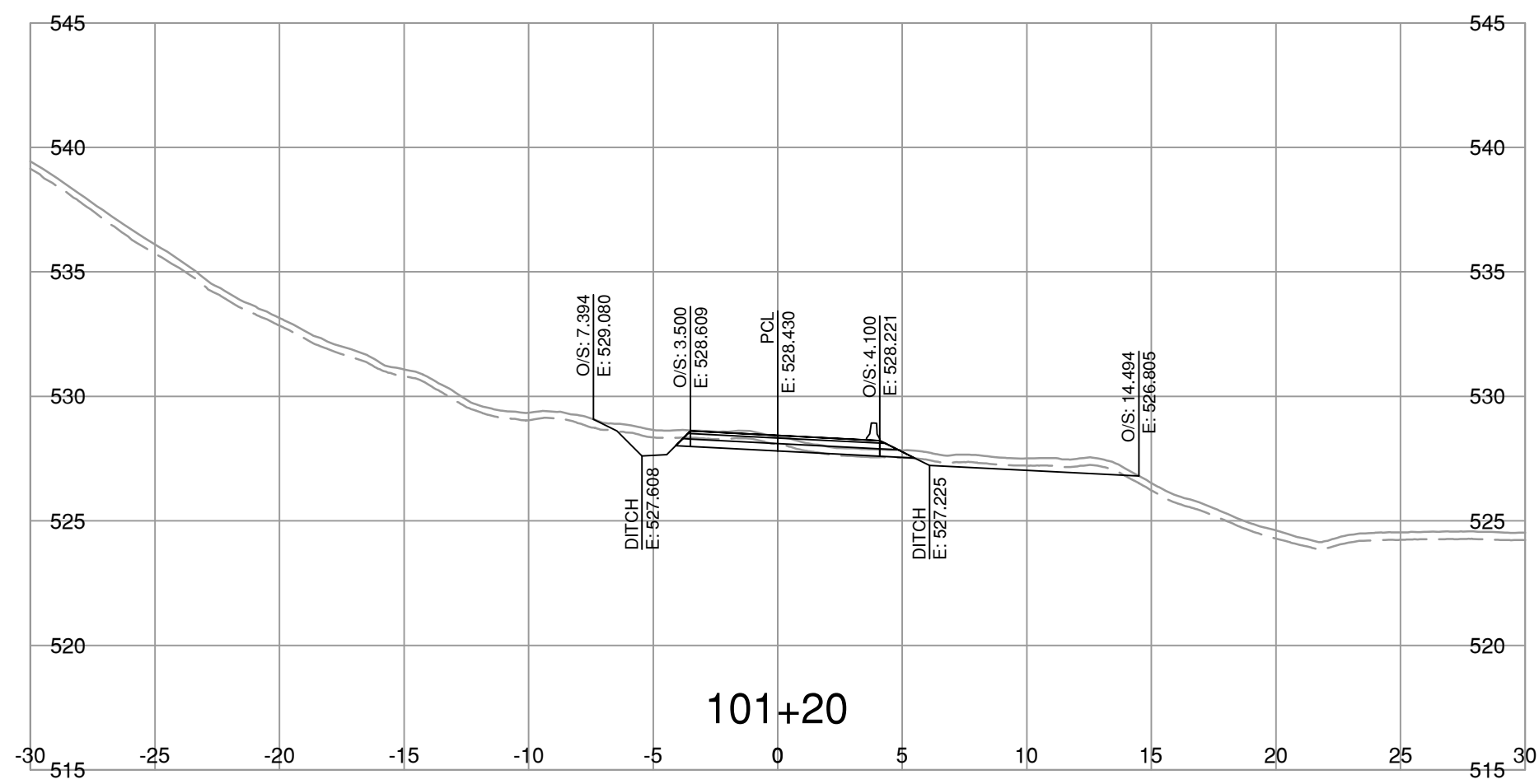
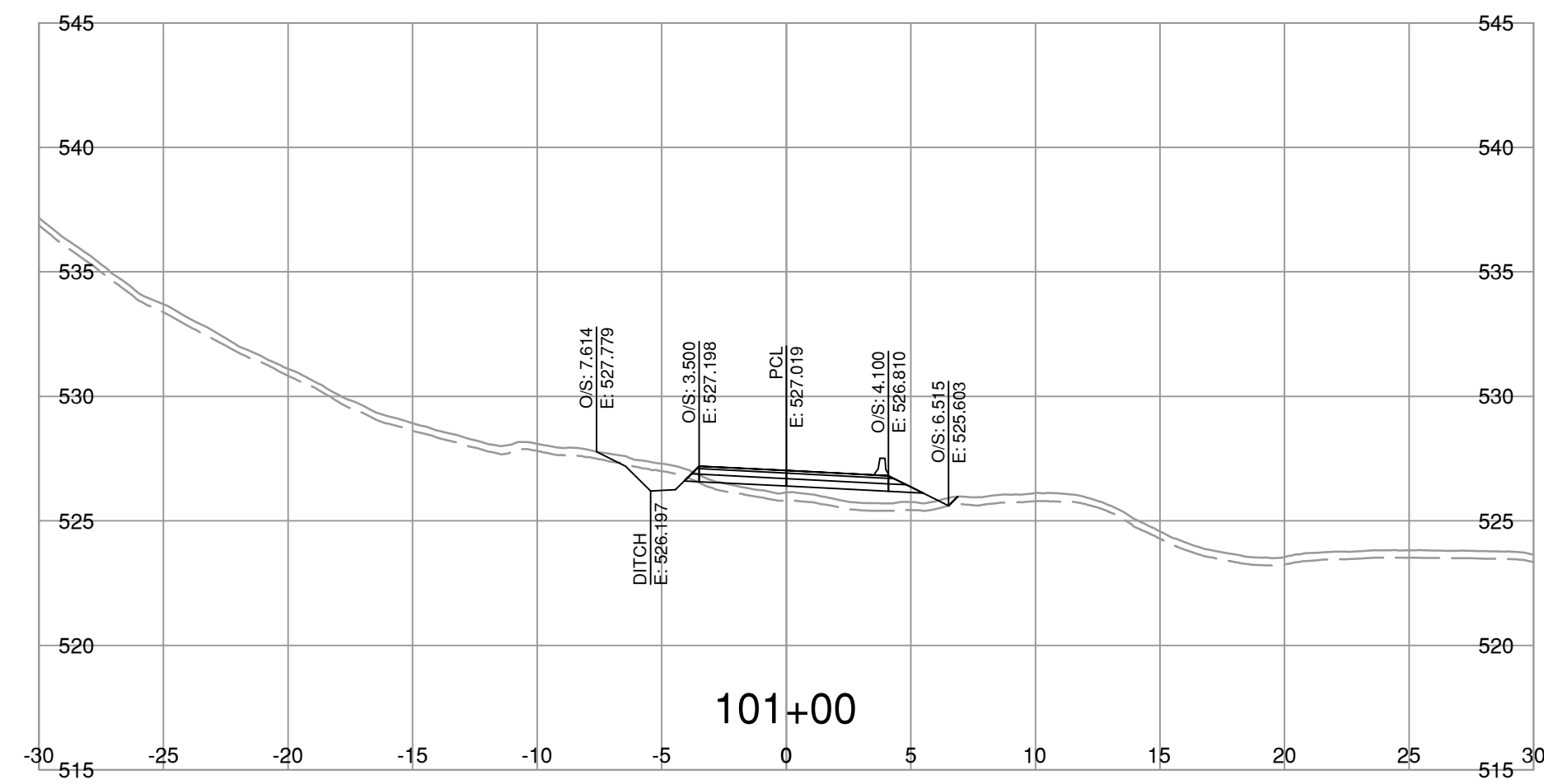
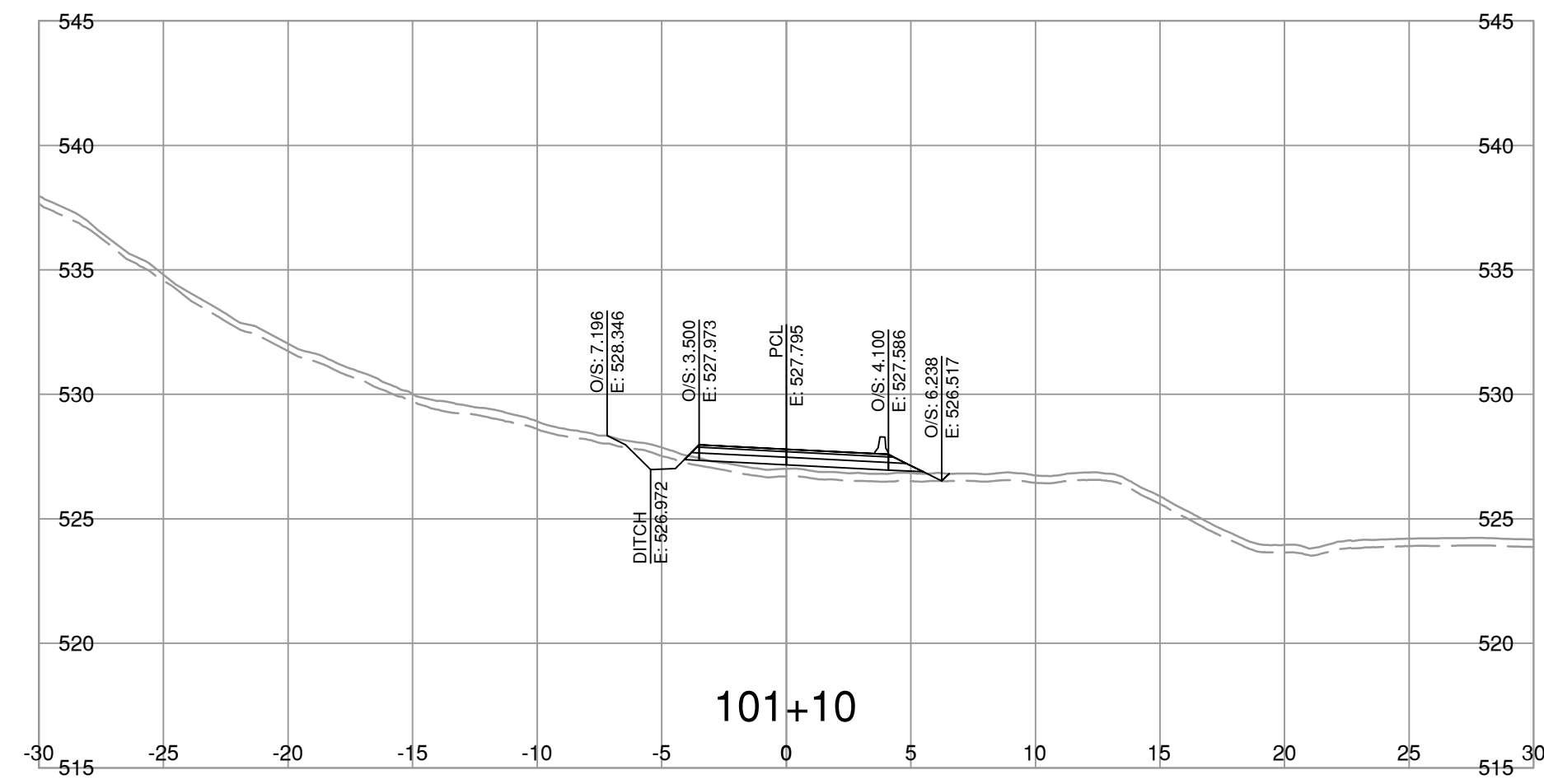
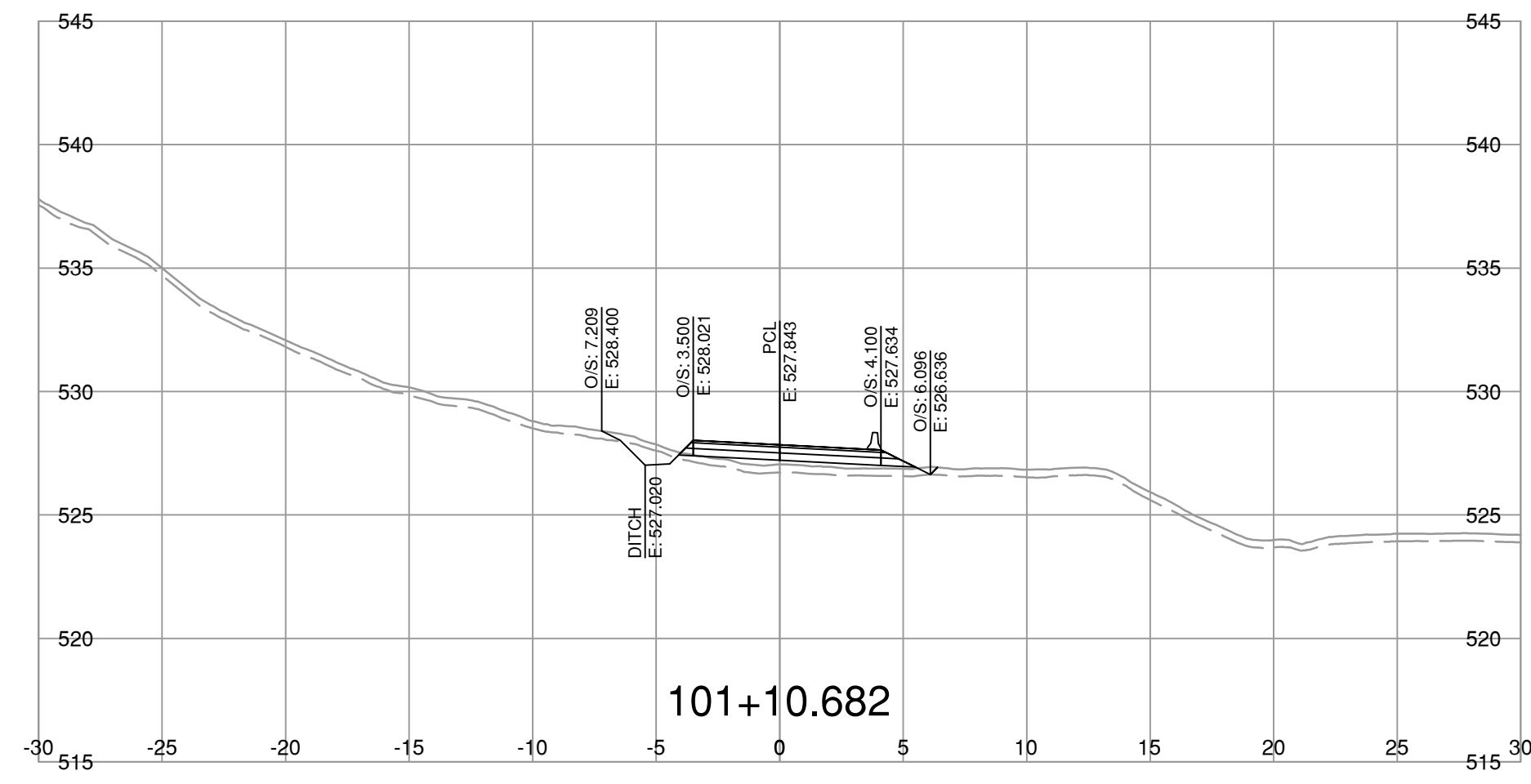
NOTE: STRIPPING REMOVAL APPLIES ONLY TO THE AREA BETWEEN SLOPE STAKE LINES (TOES & TOP OF CUT) OF PROPOSED ROADWAY TEMPLATE

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FOR DISCUSSION ONLY - MAR. 31, 2023

		R.F. BINNIE & ASSOCIATES LTD. 300 - 4940 Canada Way, Burnaby, BC V5G 4K6 TEL 604 420 1721 BINNIE.com		BRITISH COLUMBIA		MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE SOUTH COAST REGION HIGHWAY ENGINEERING AND GEOMATICS																																			
SCALE 0 2 1:250 12m		CAD FILENAME SECT-L100AS.DWG		DATE 2023-03-23		FILE NUMBER 22-0953																																			
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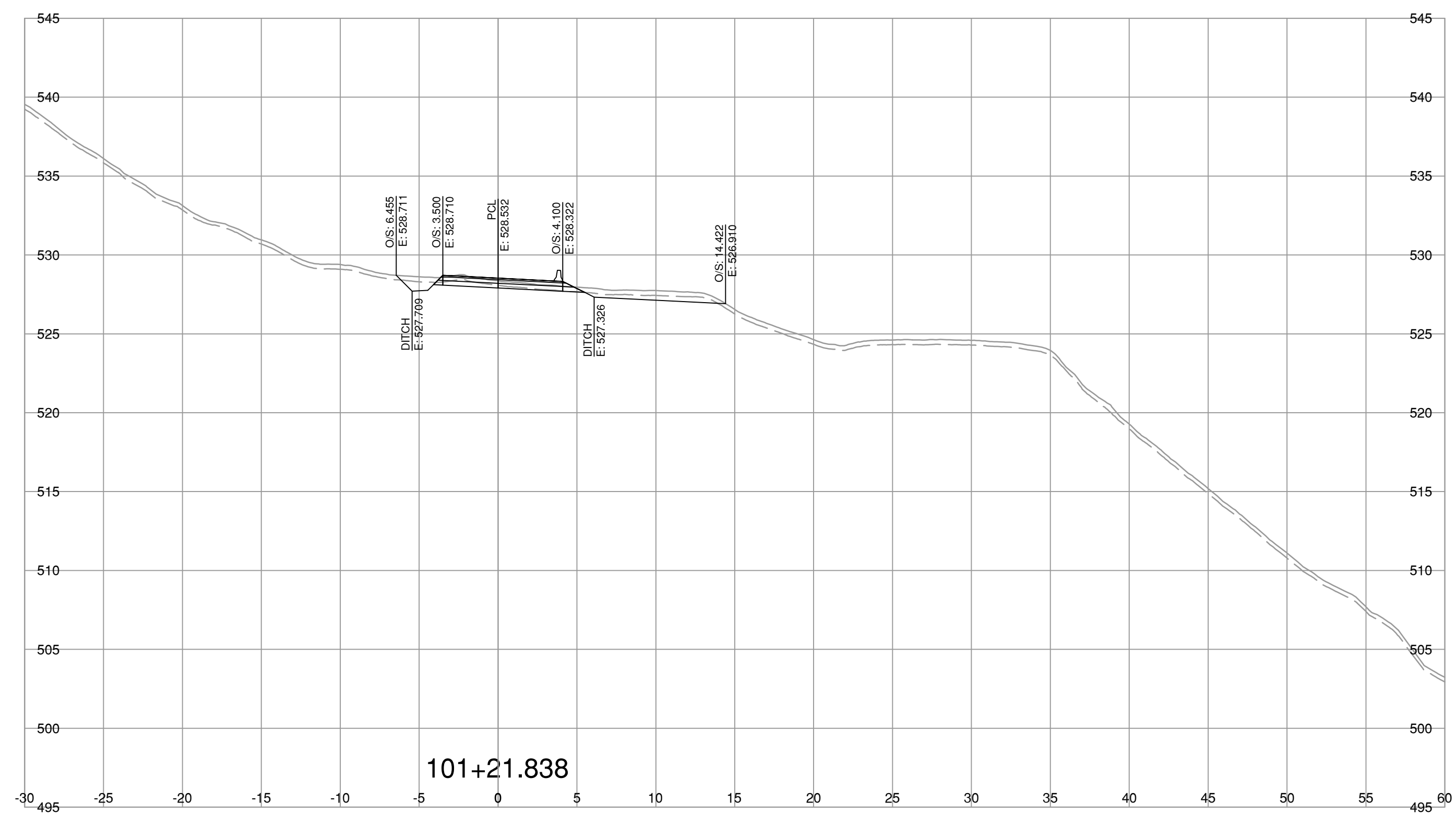
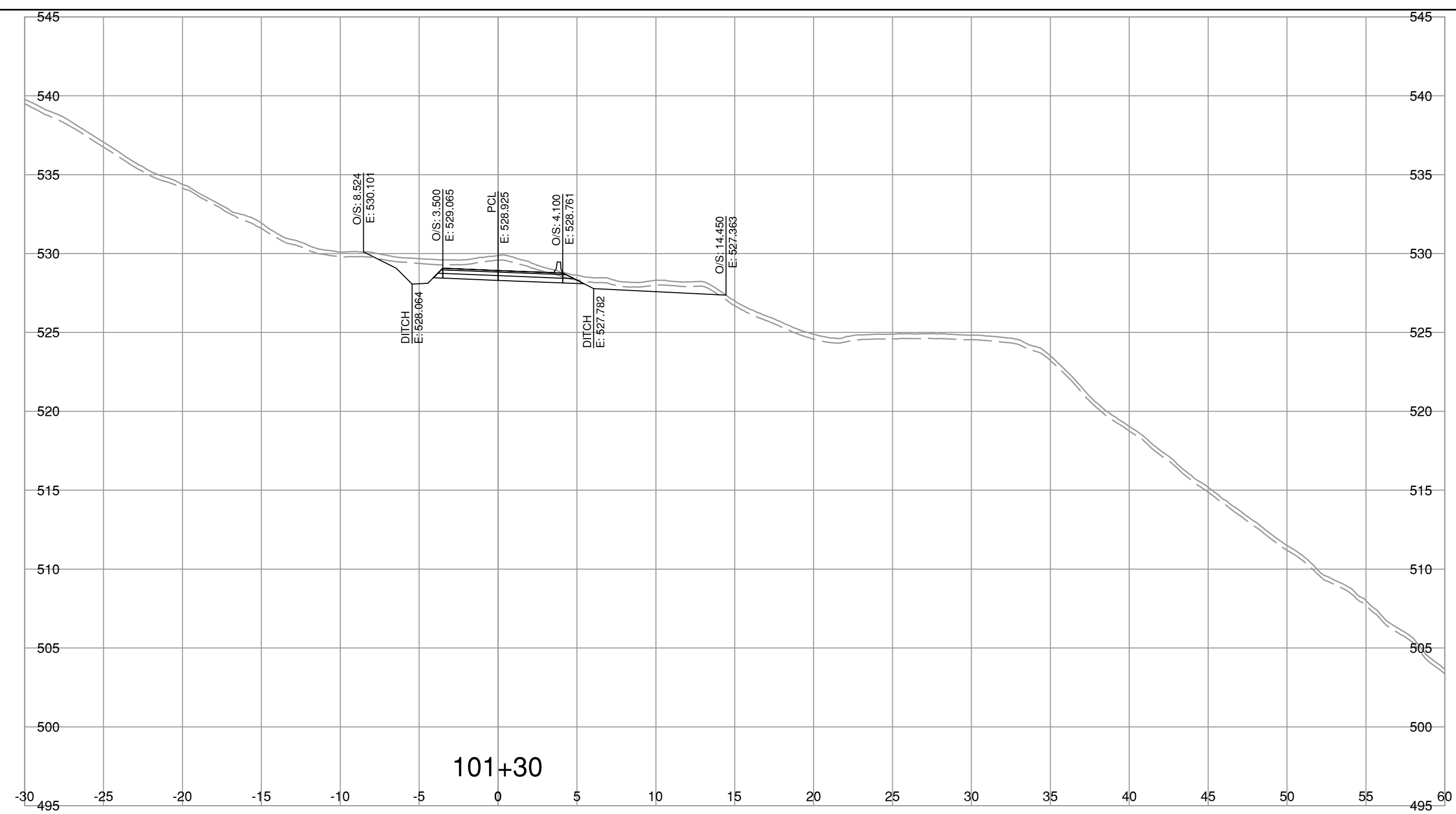
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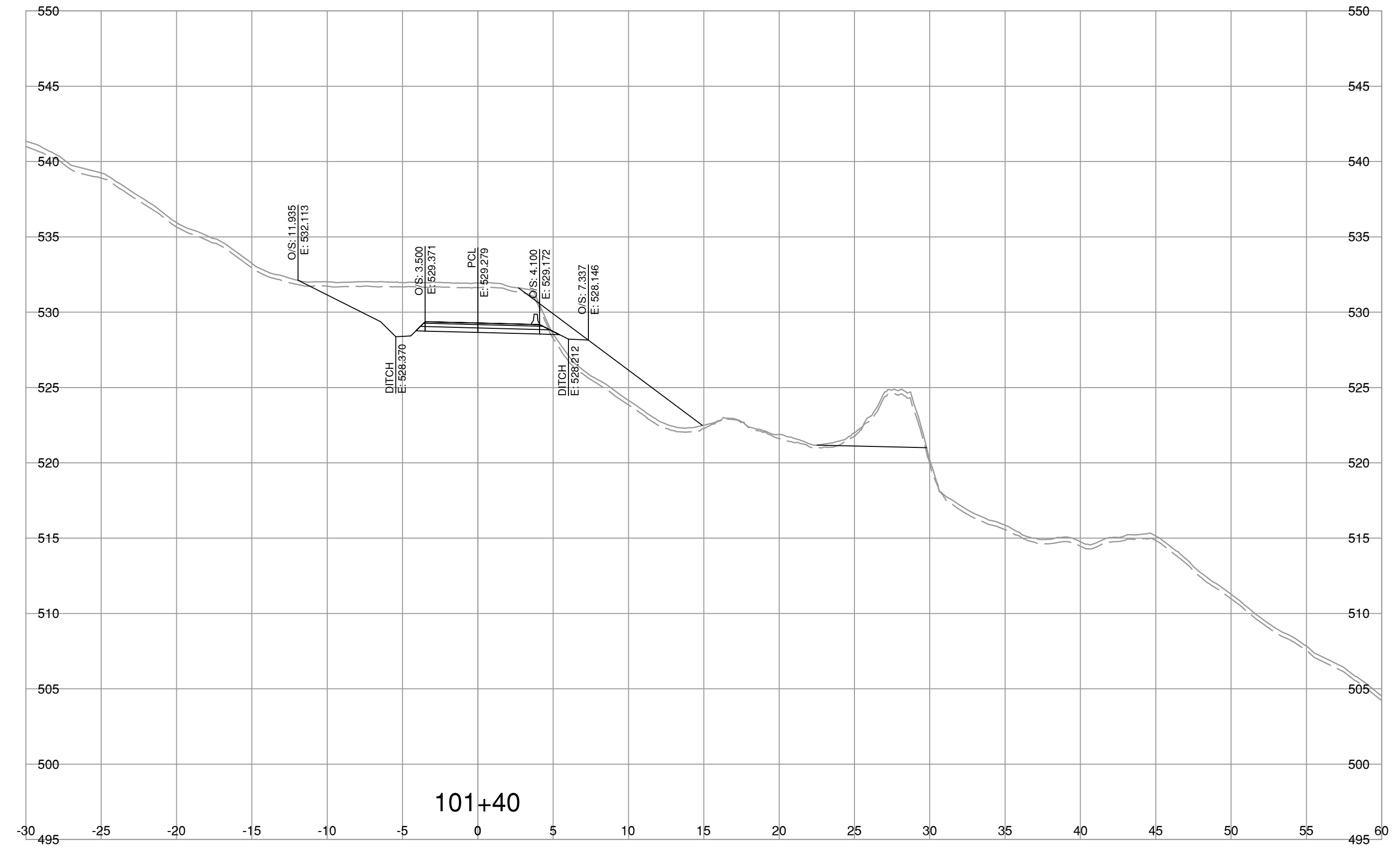
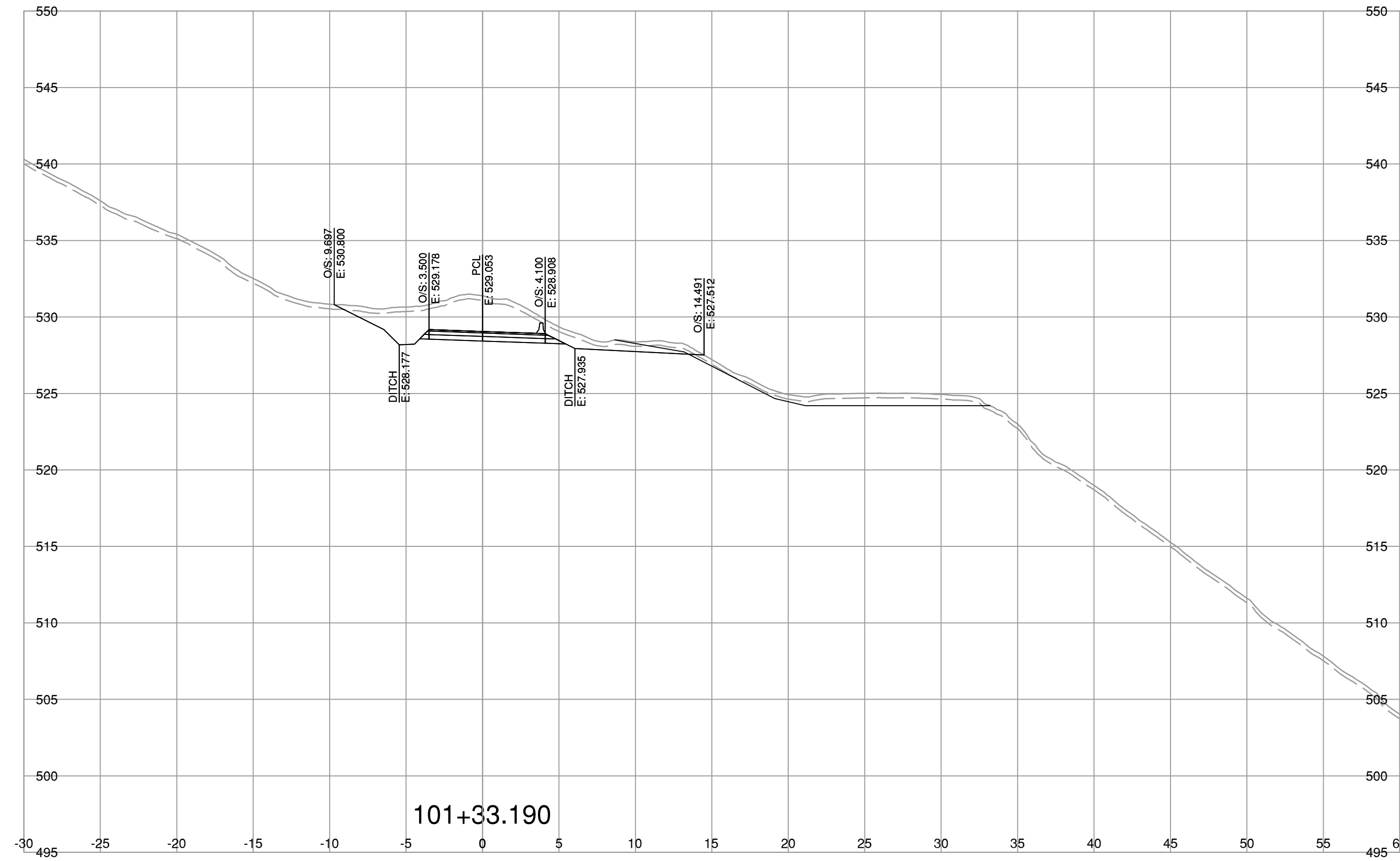
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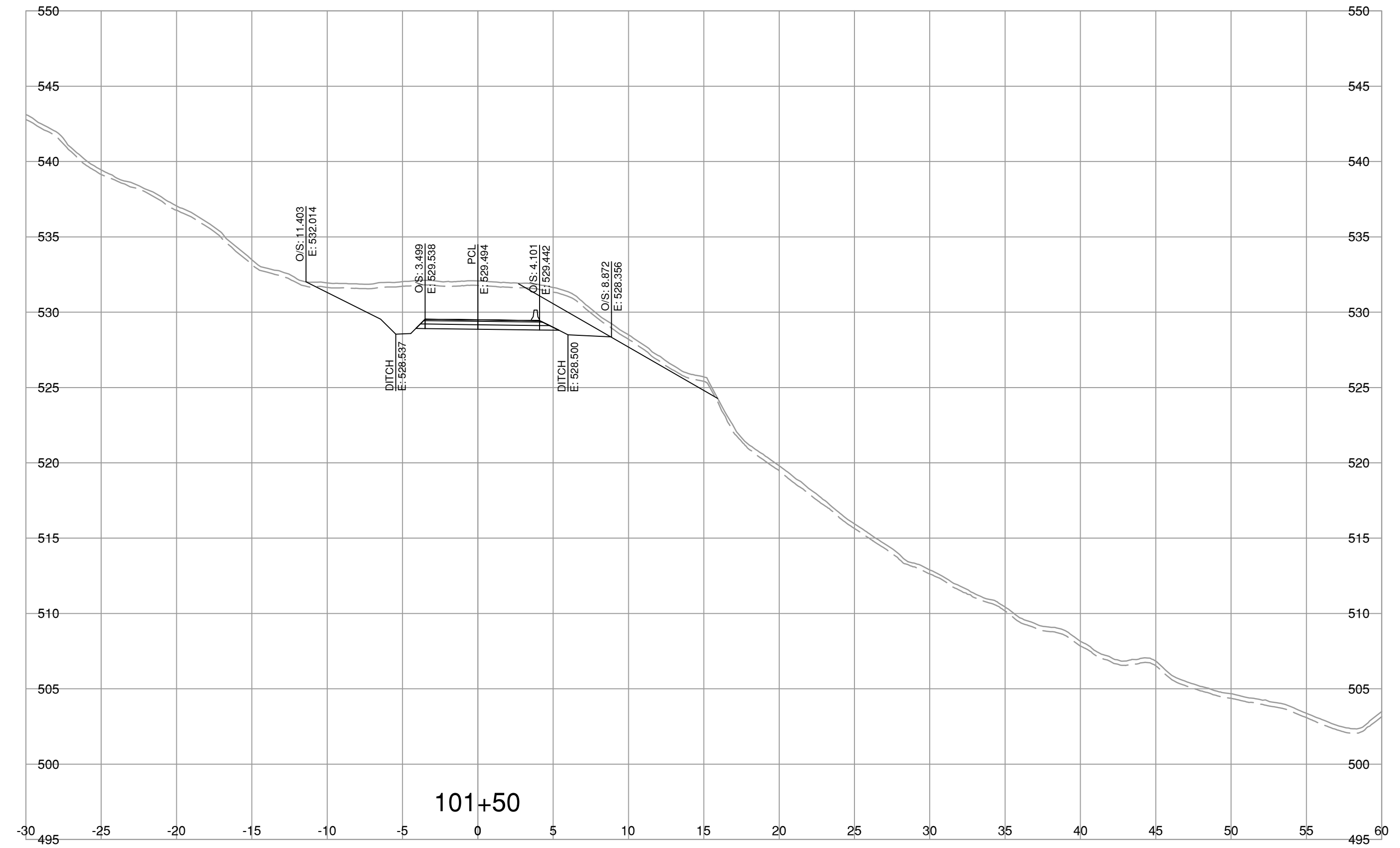
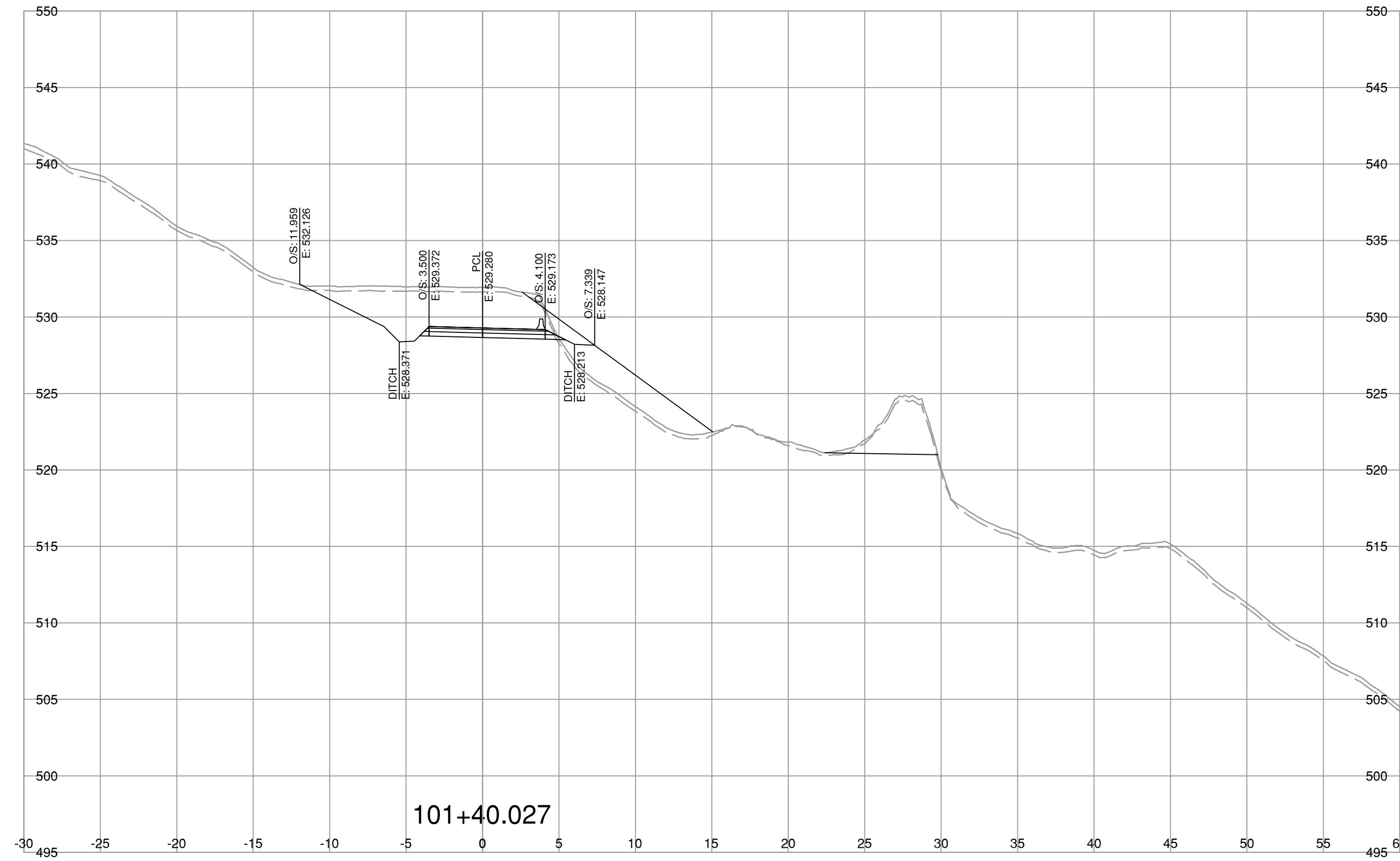
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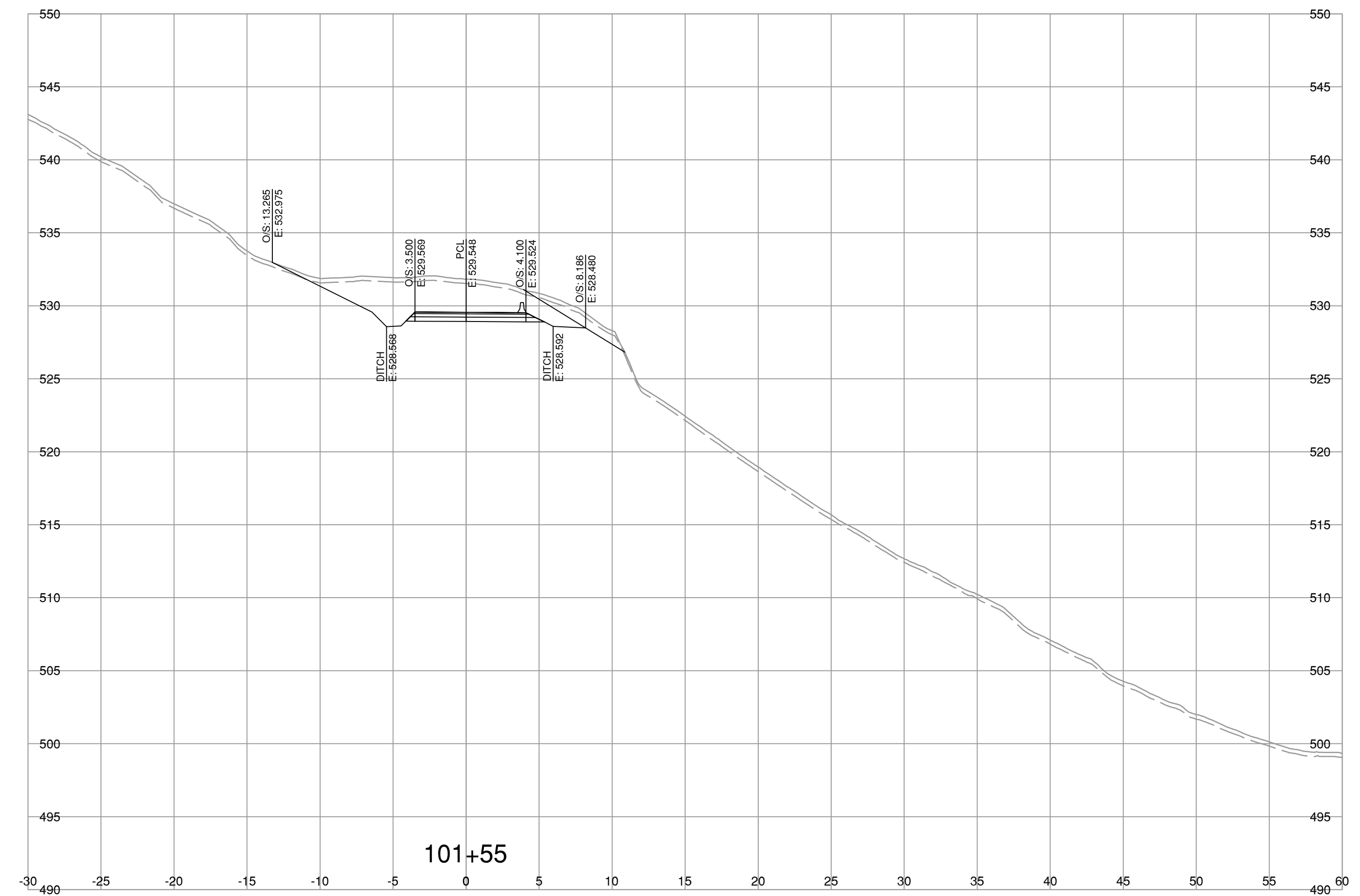
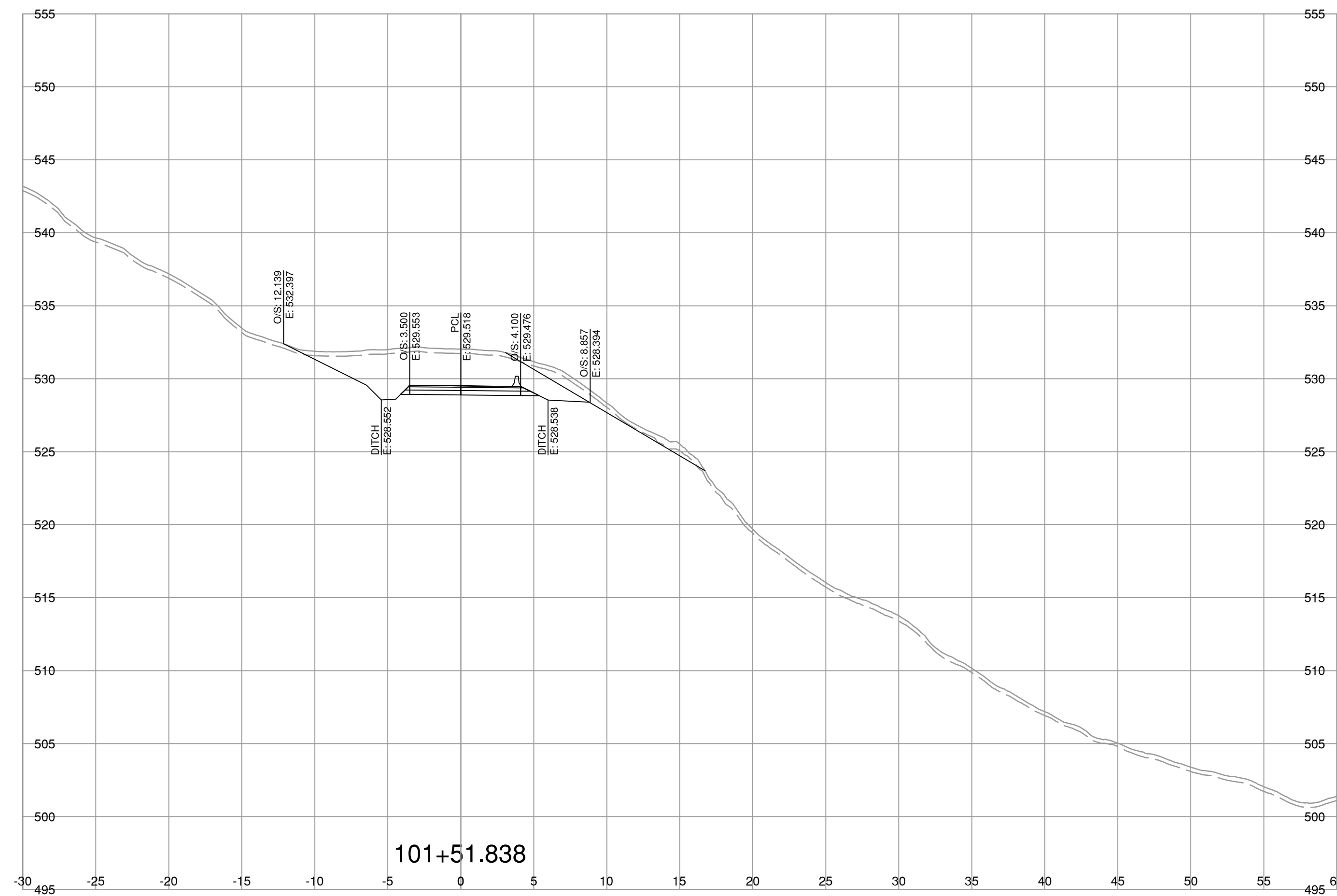
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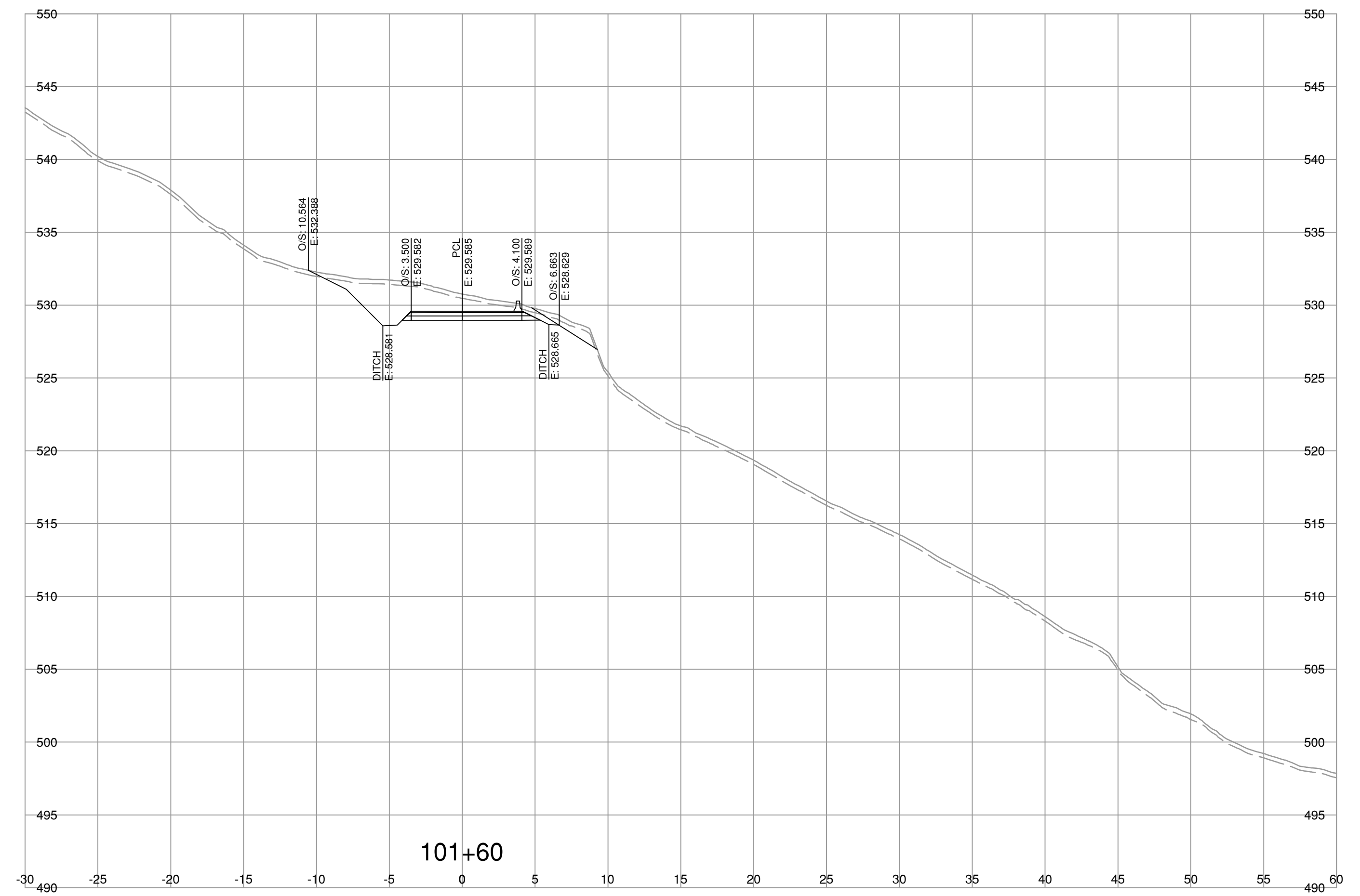
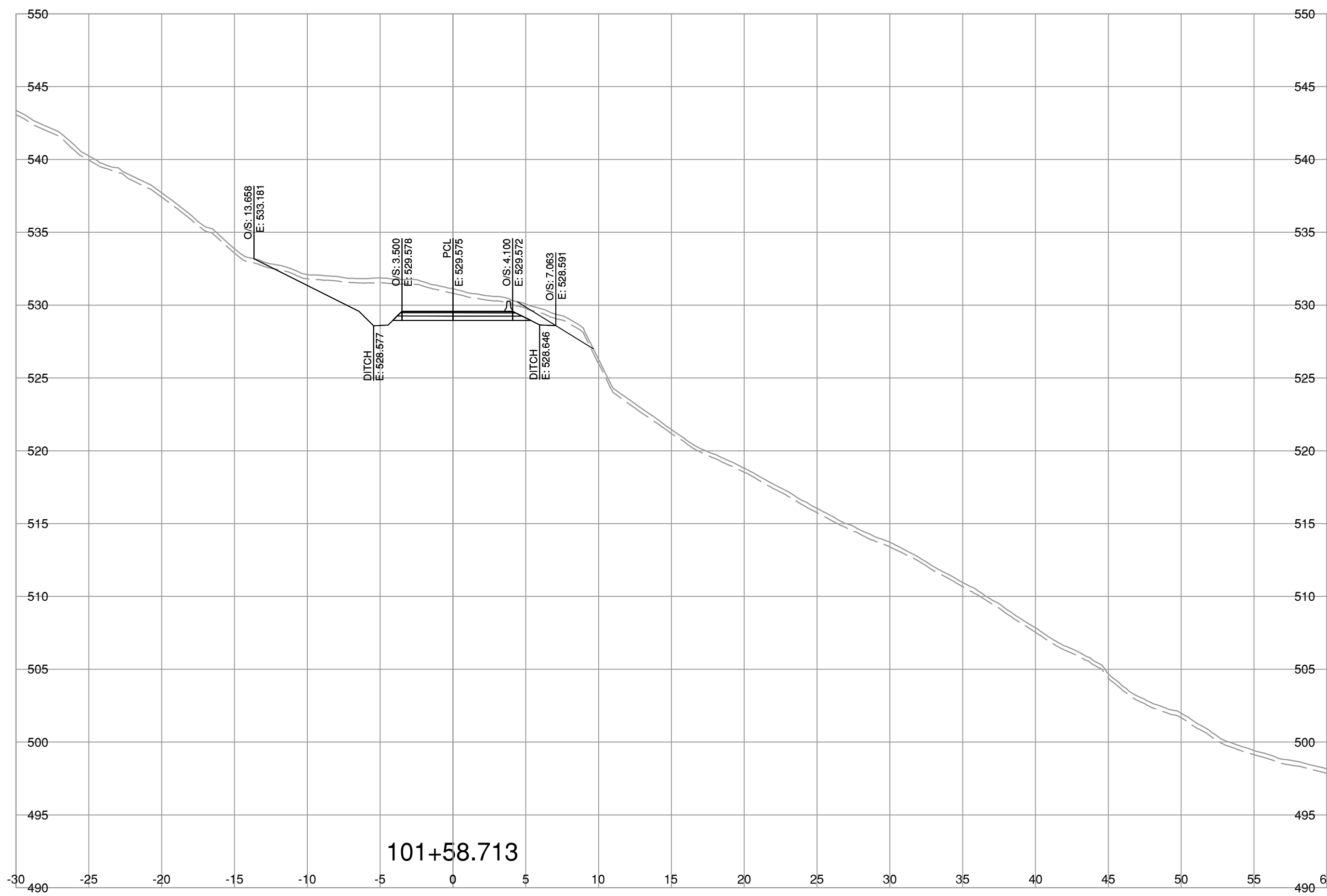
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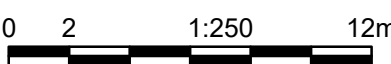


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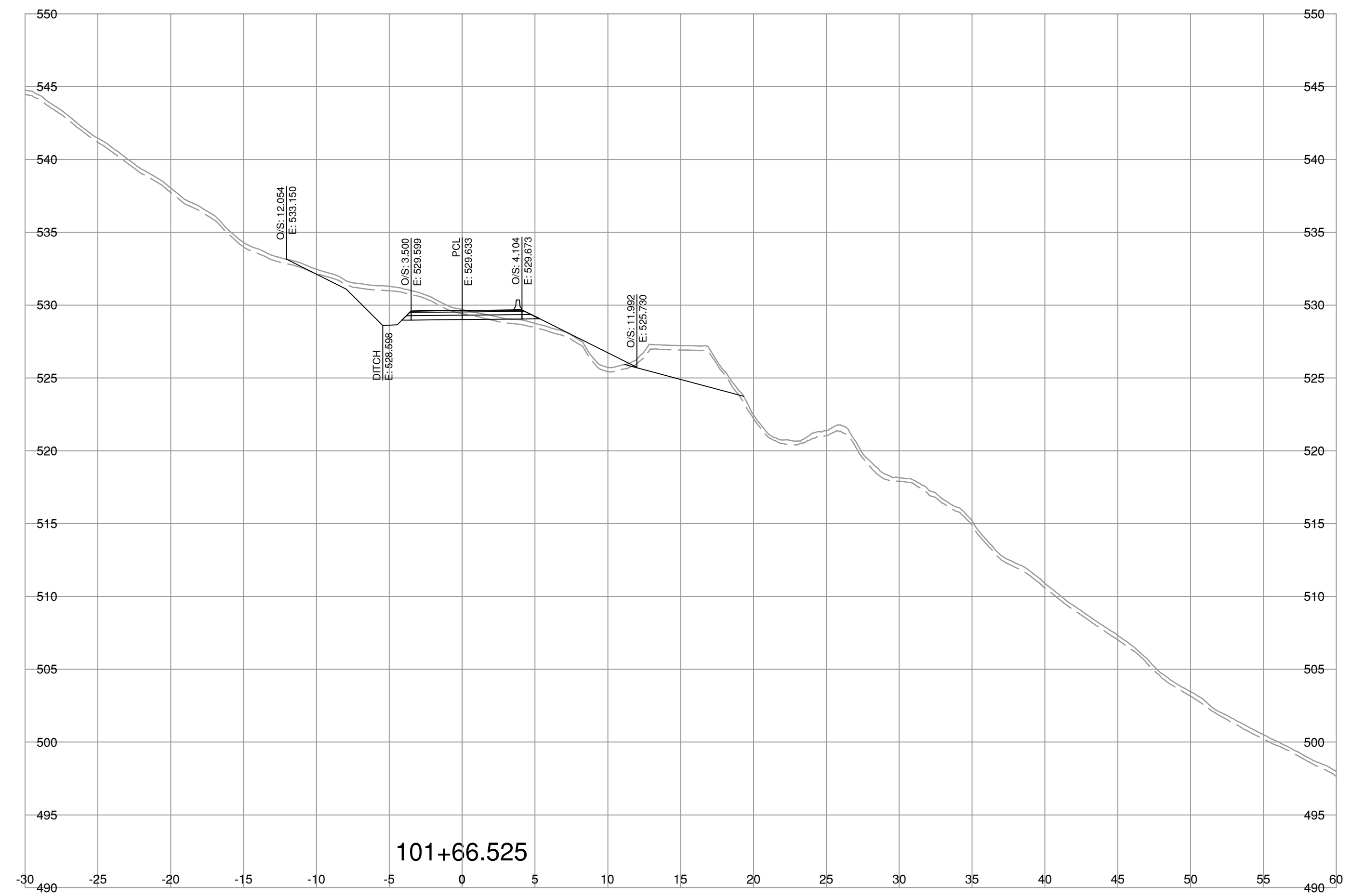
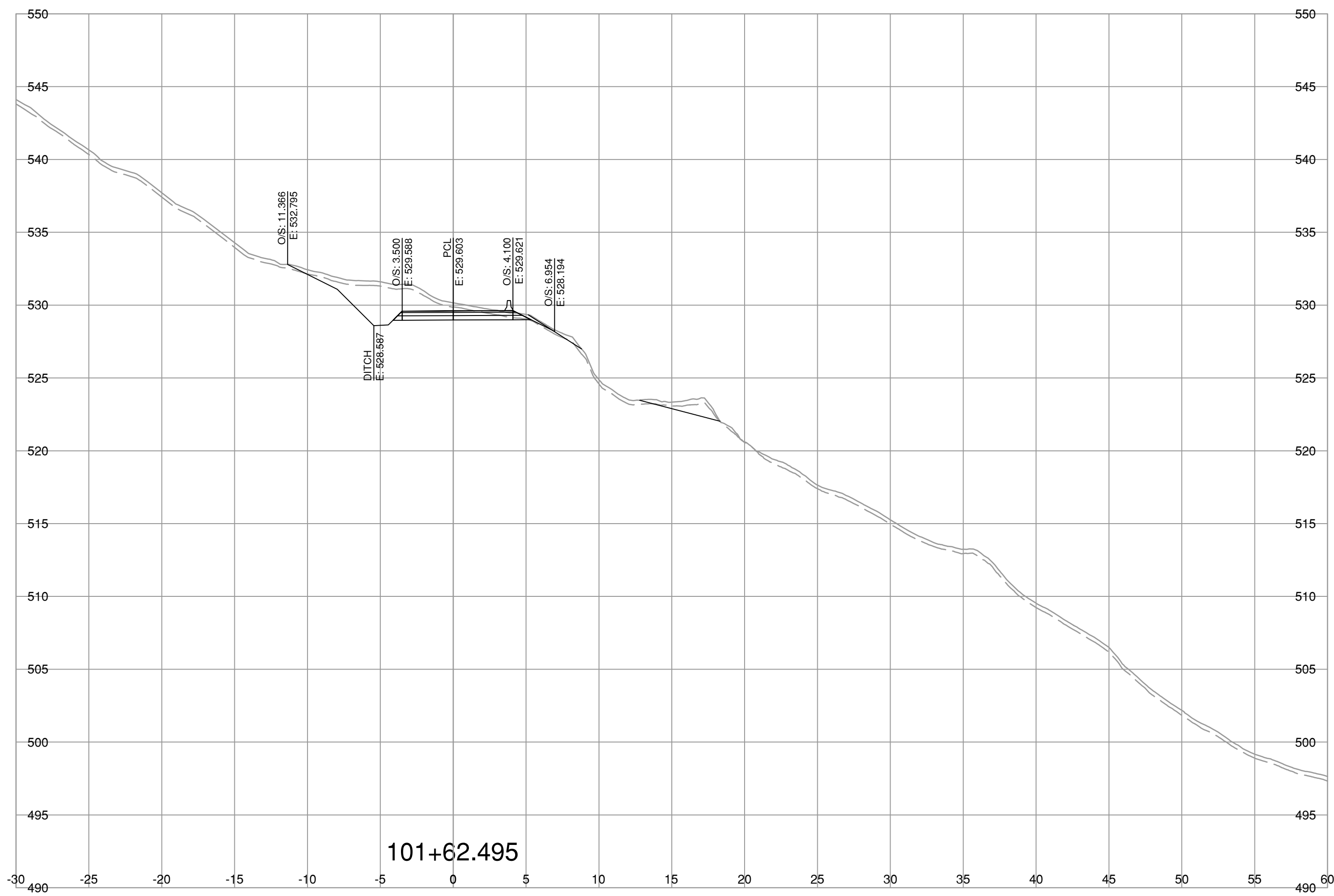
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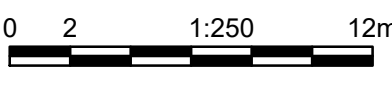


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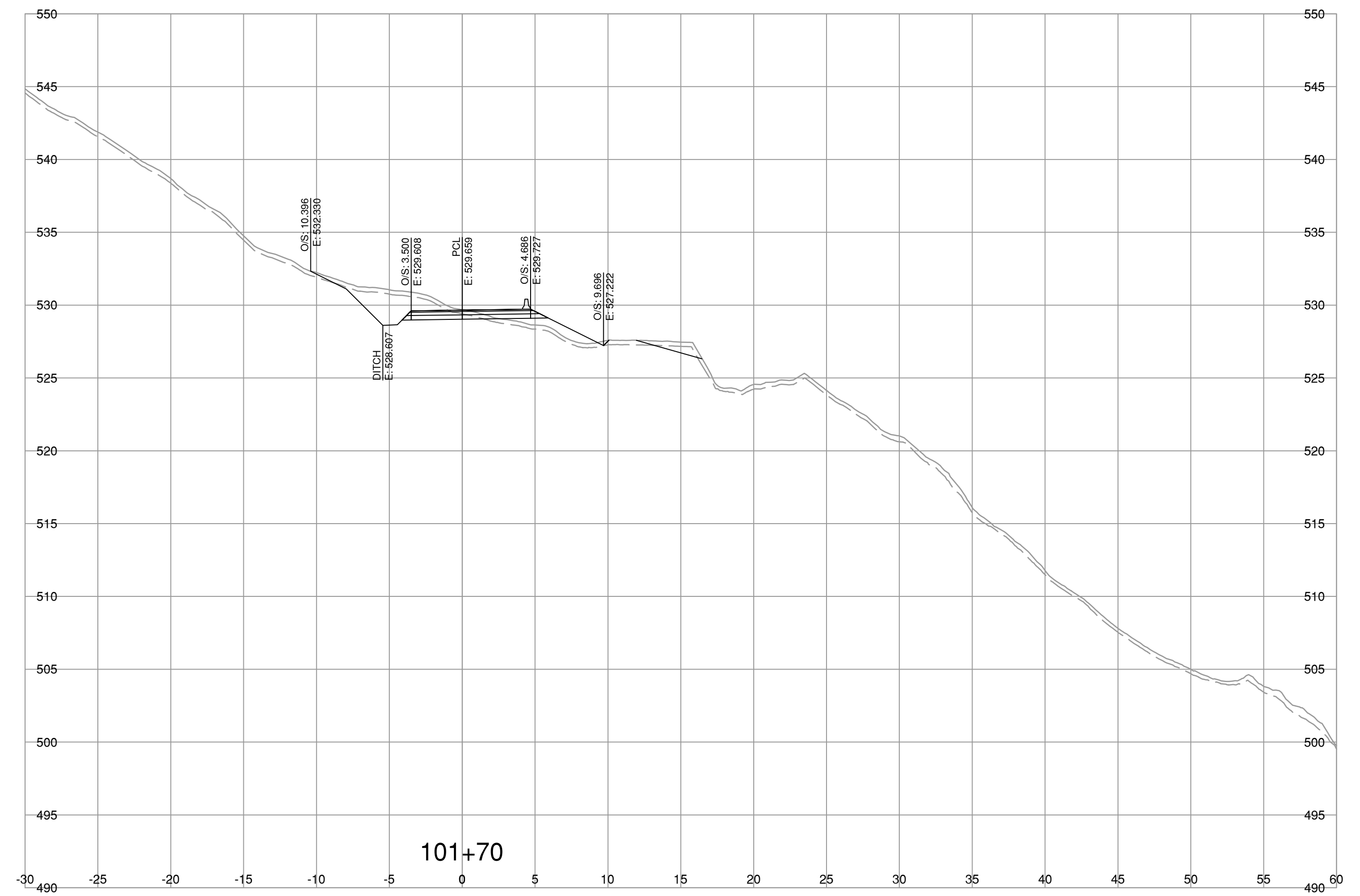
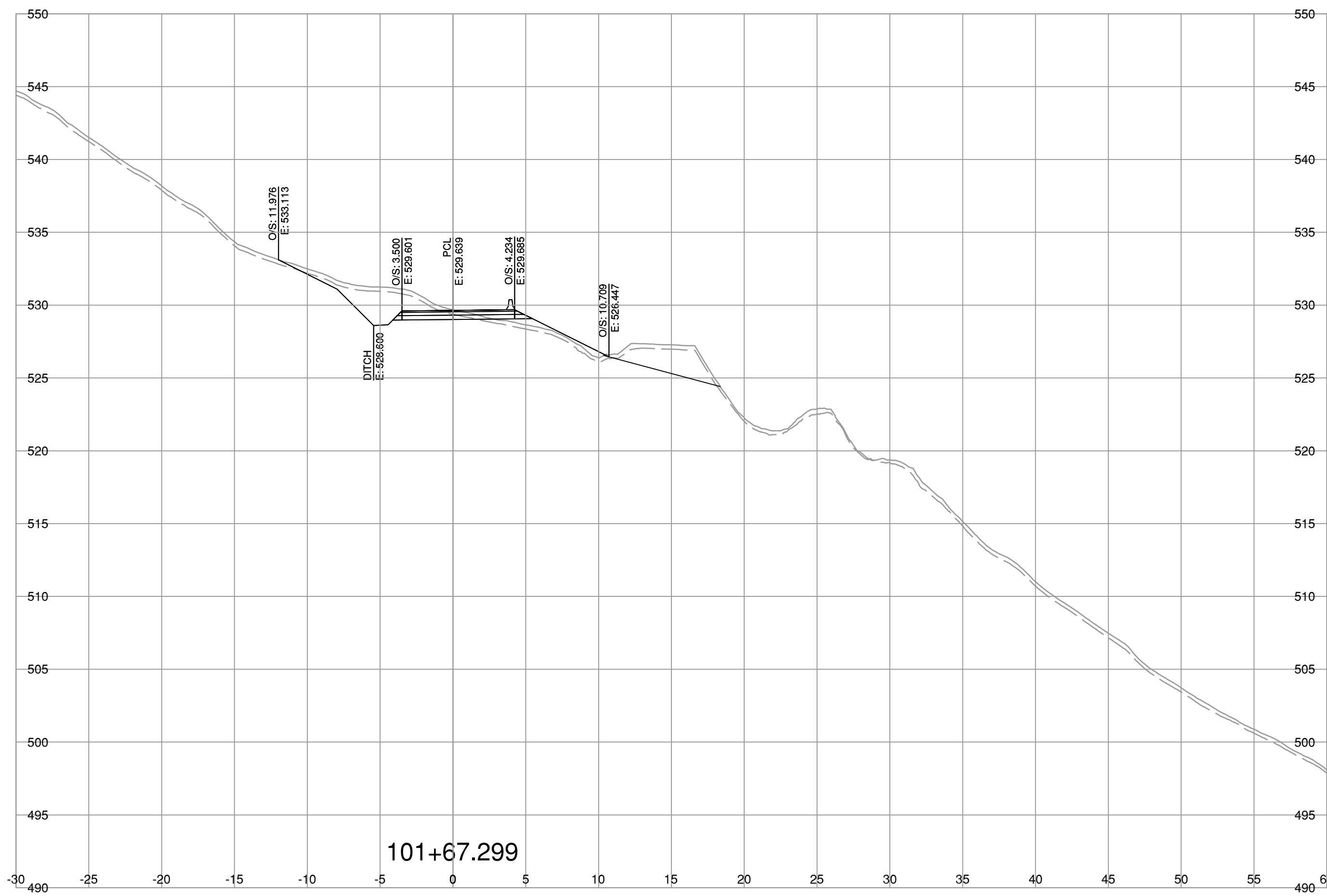
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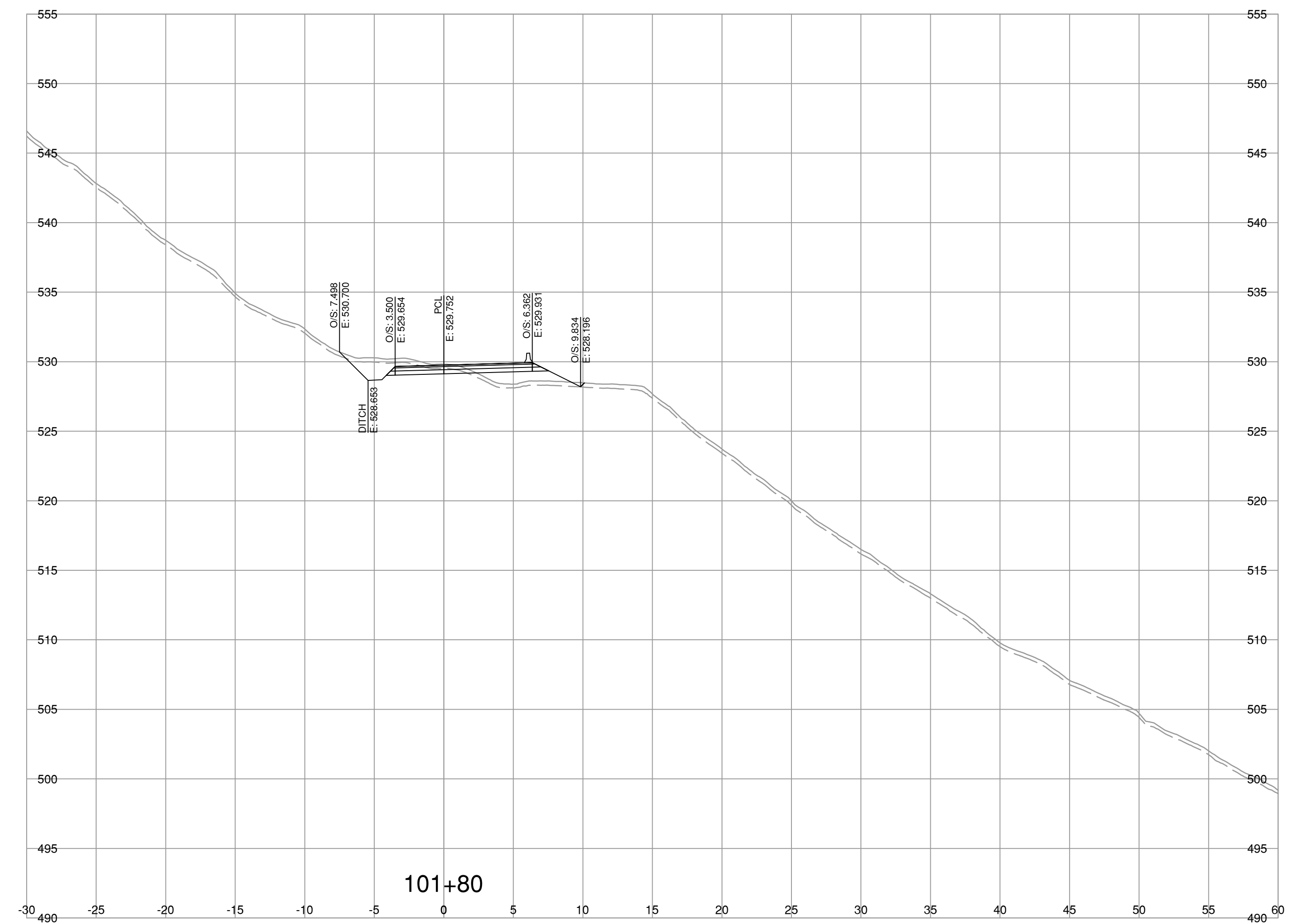
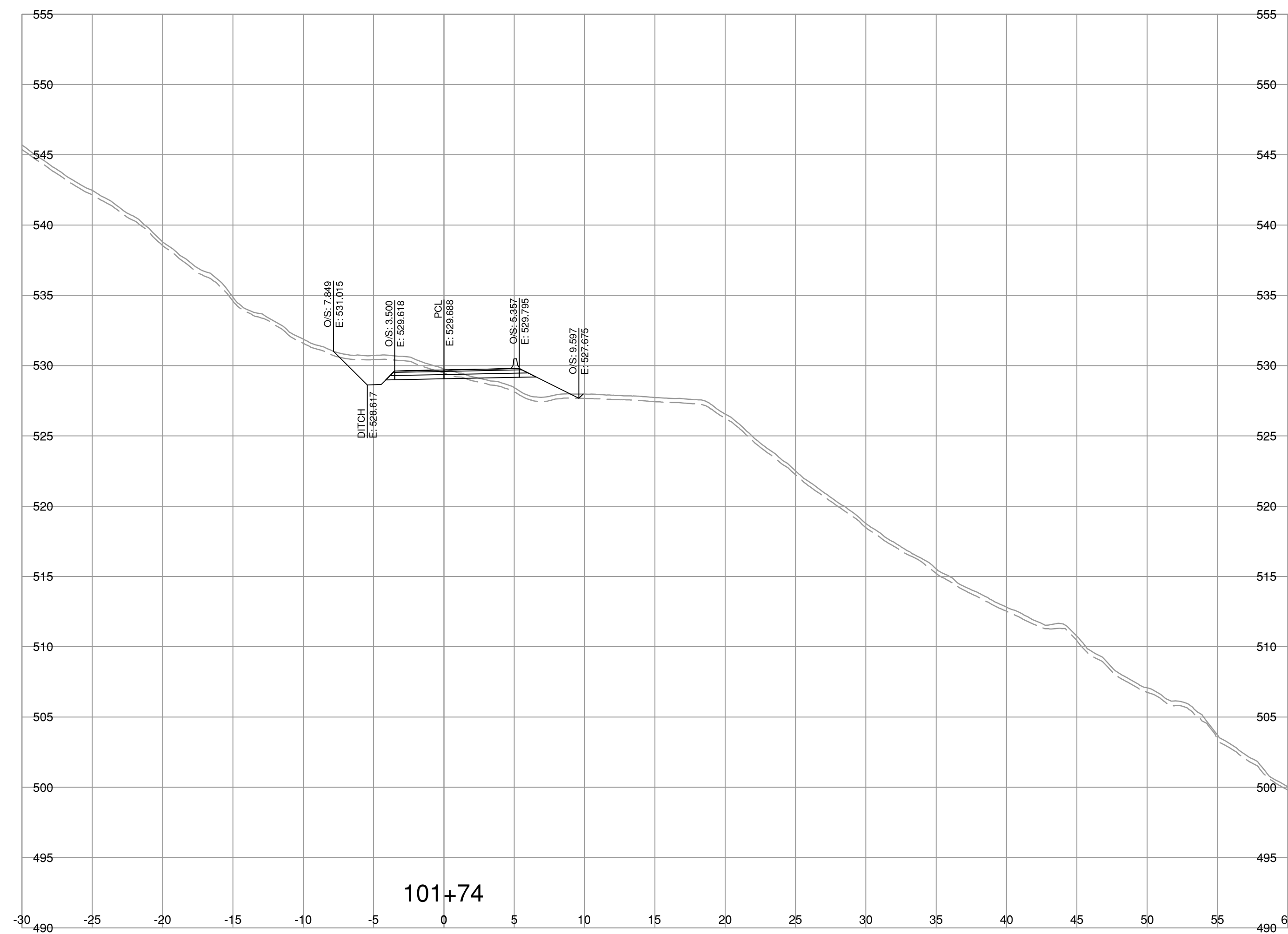
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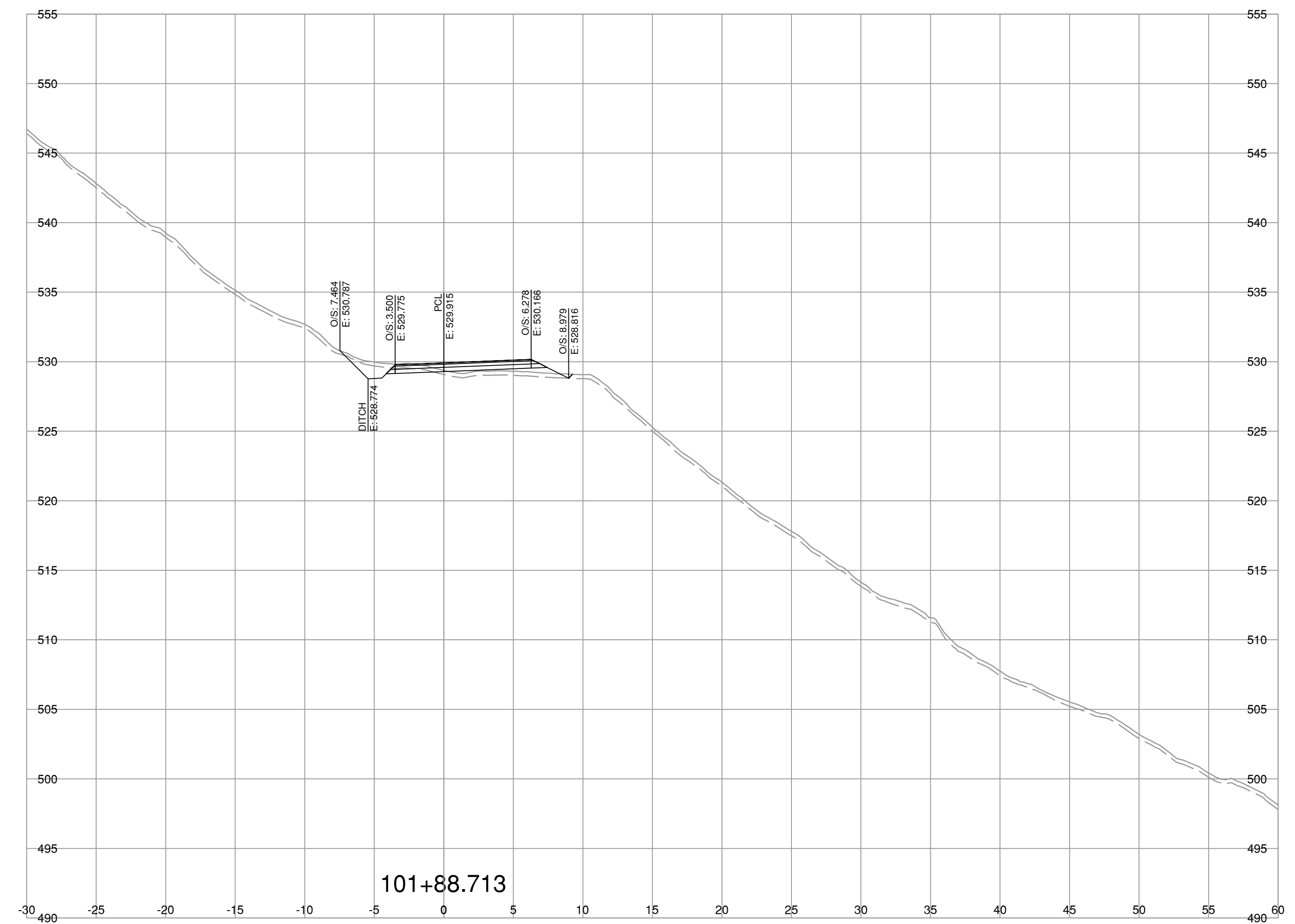
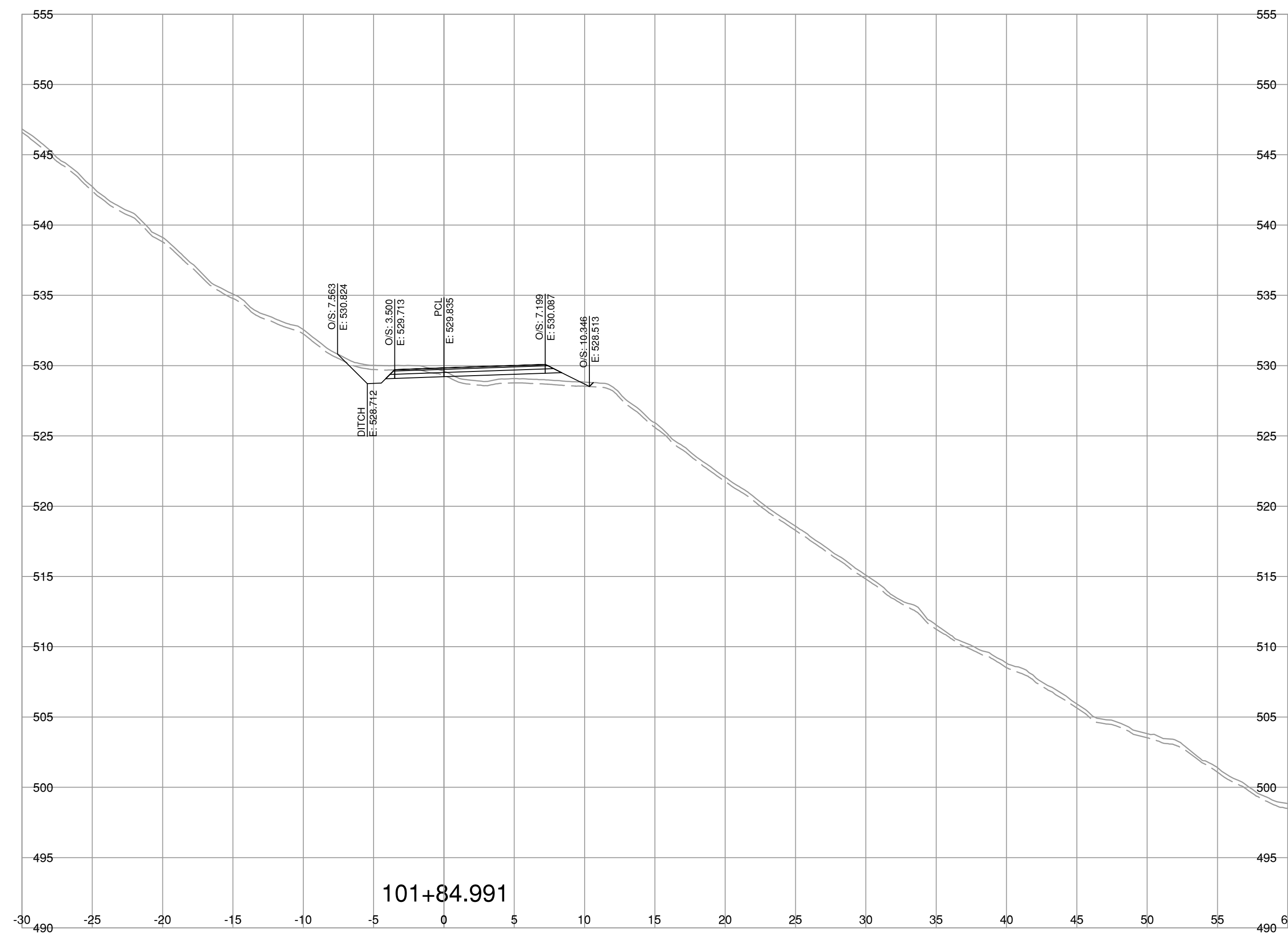
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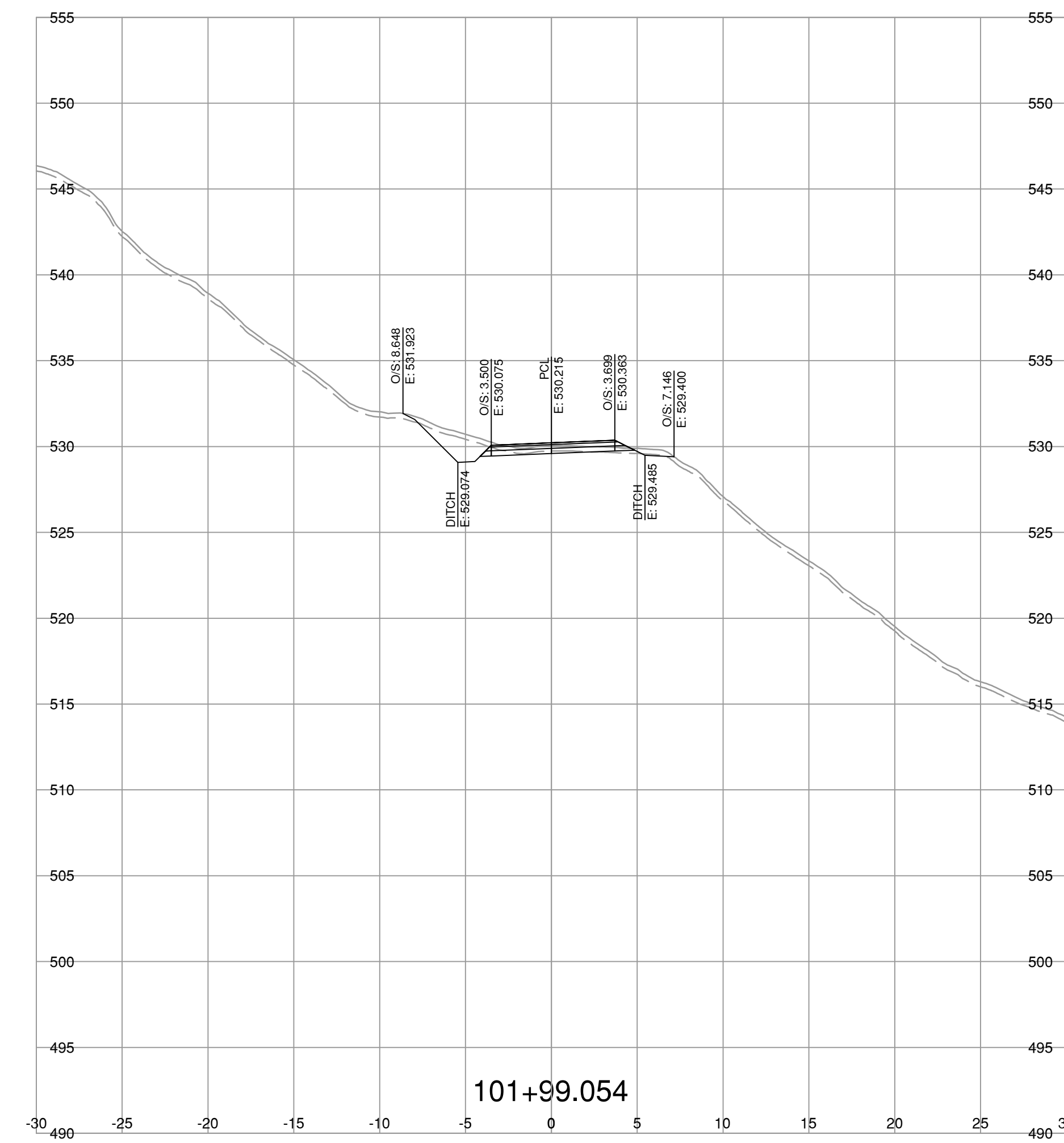
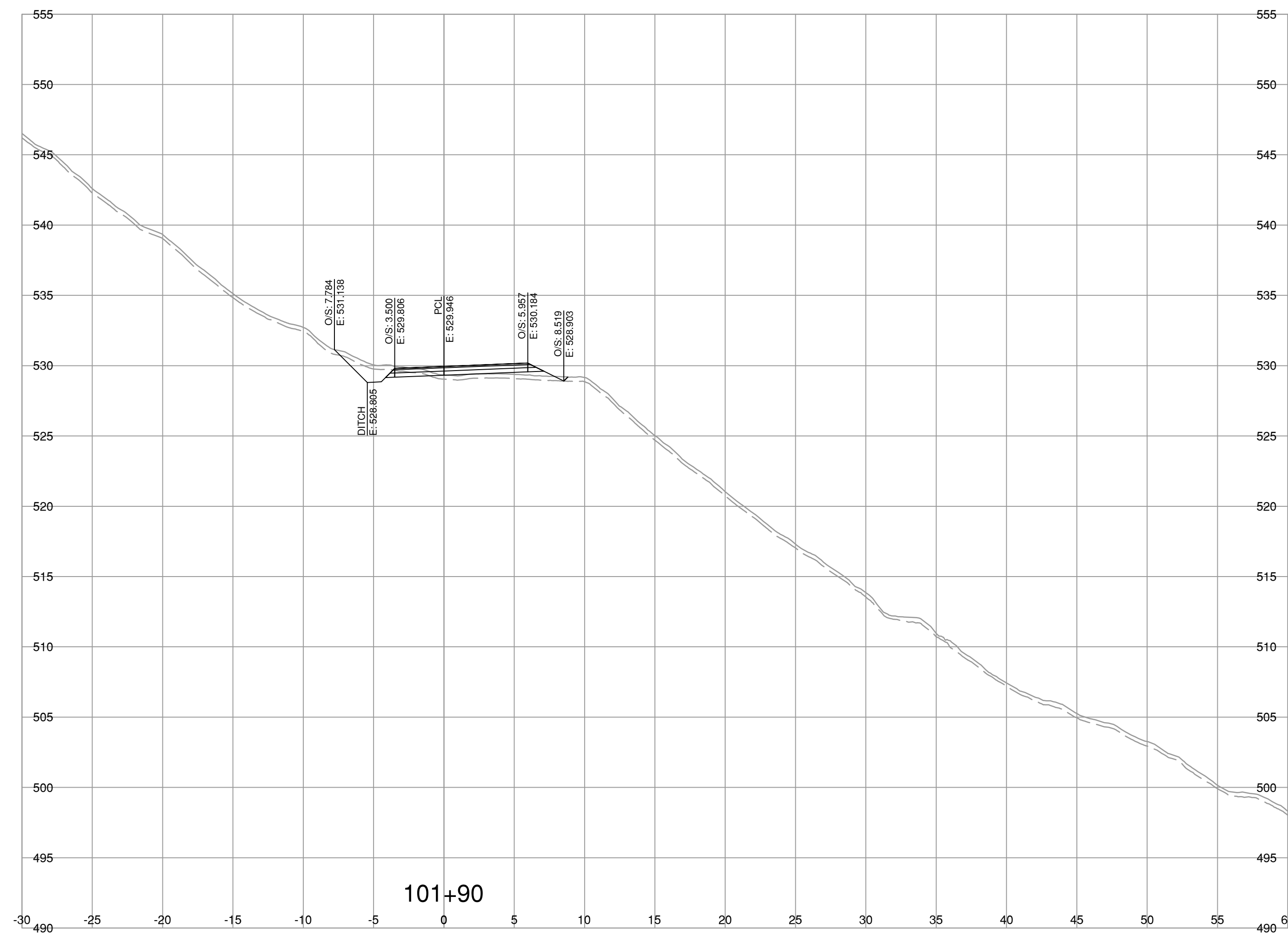
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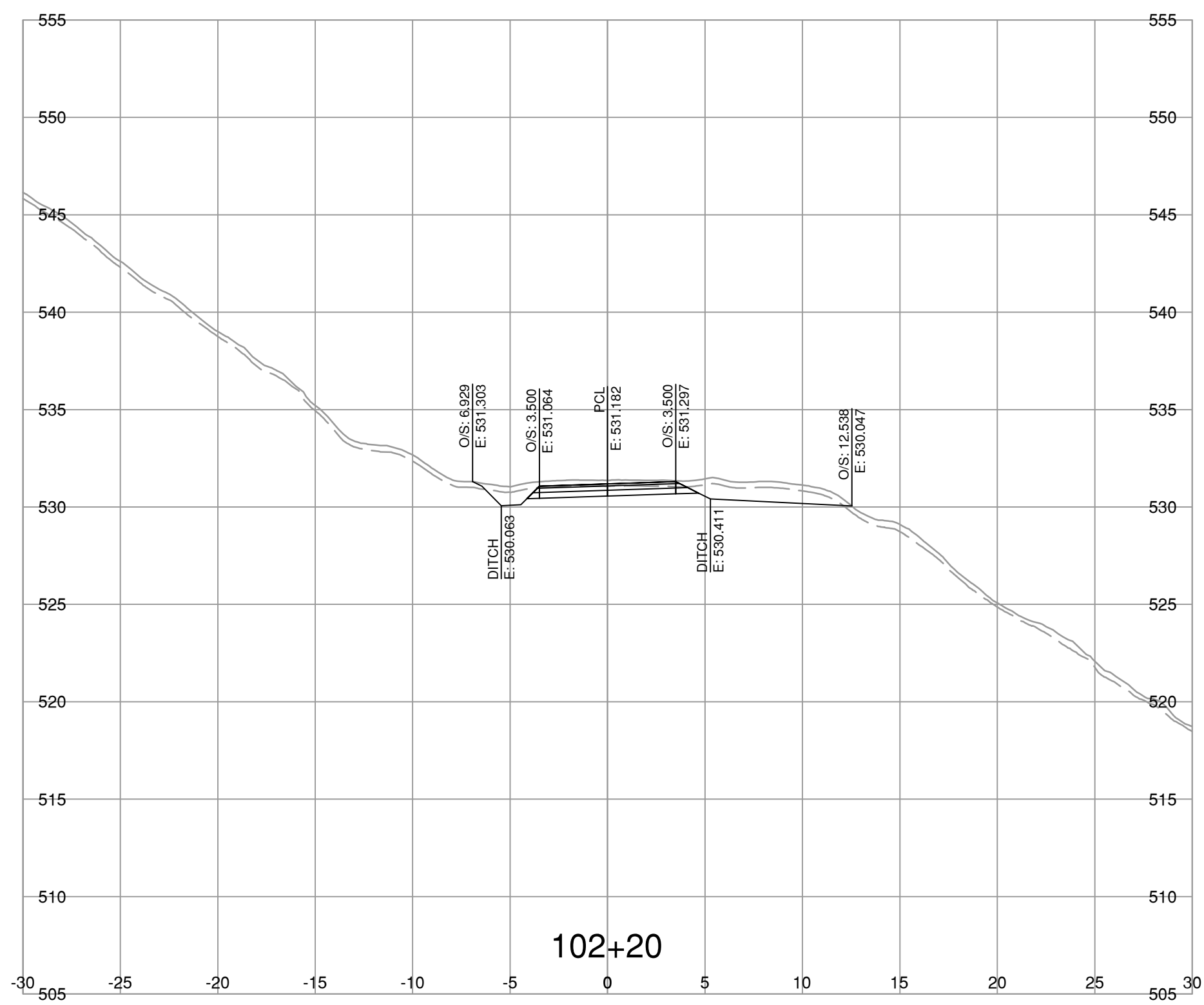
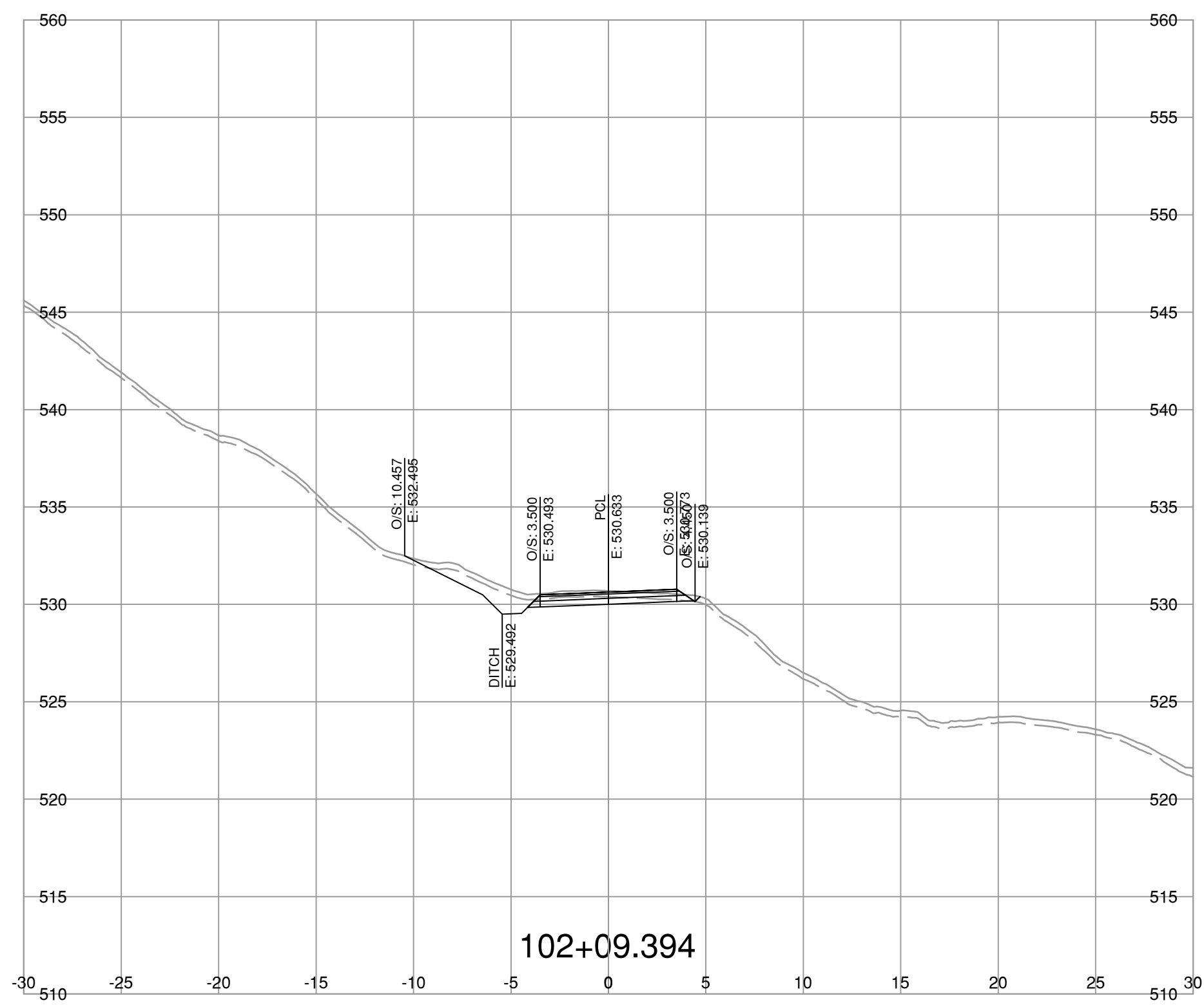
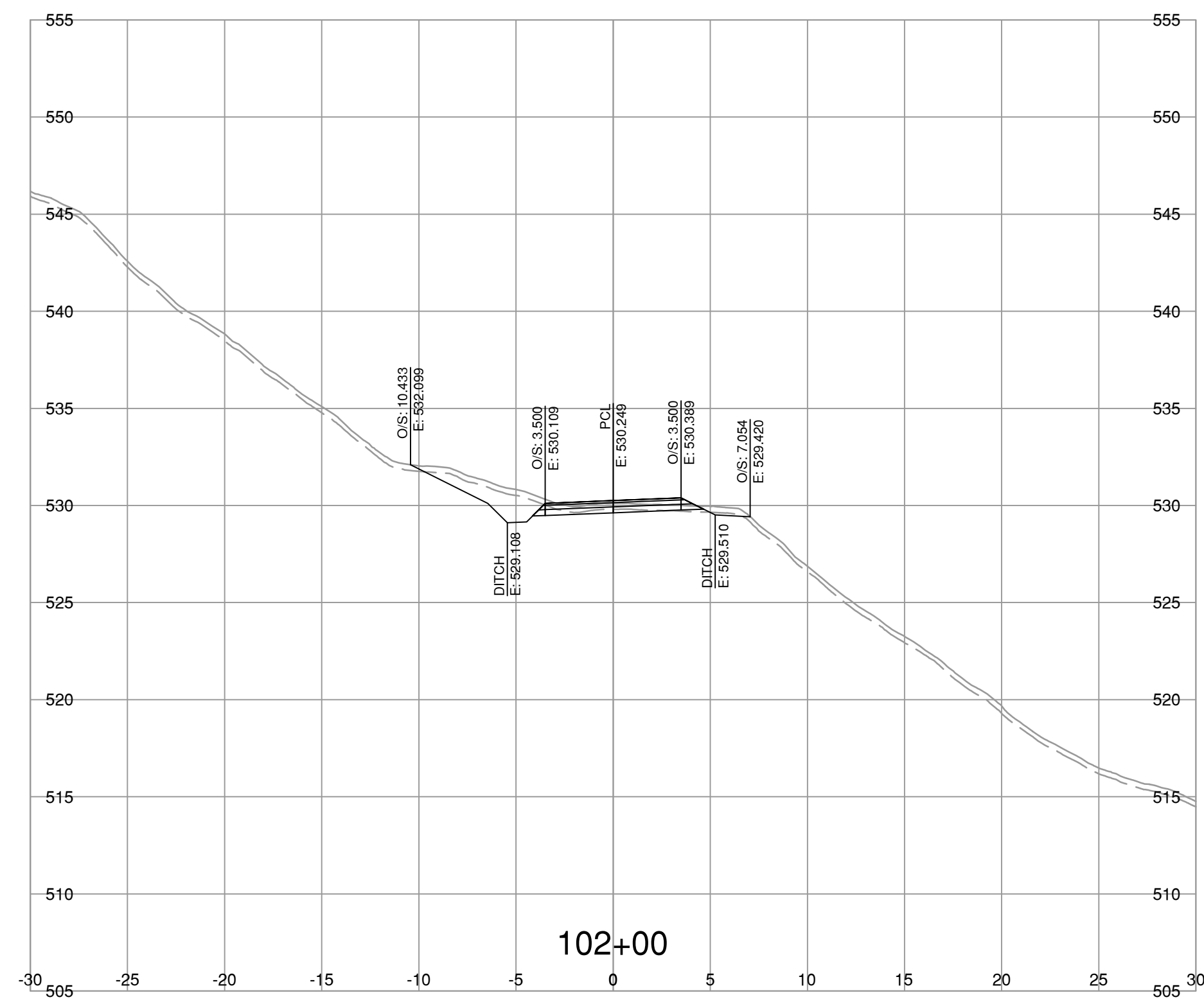
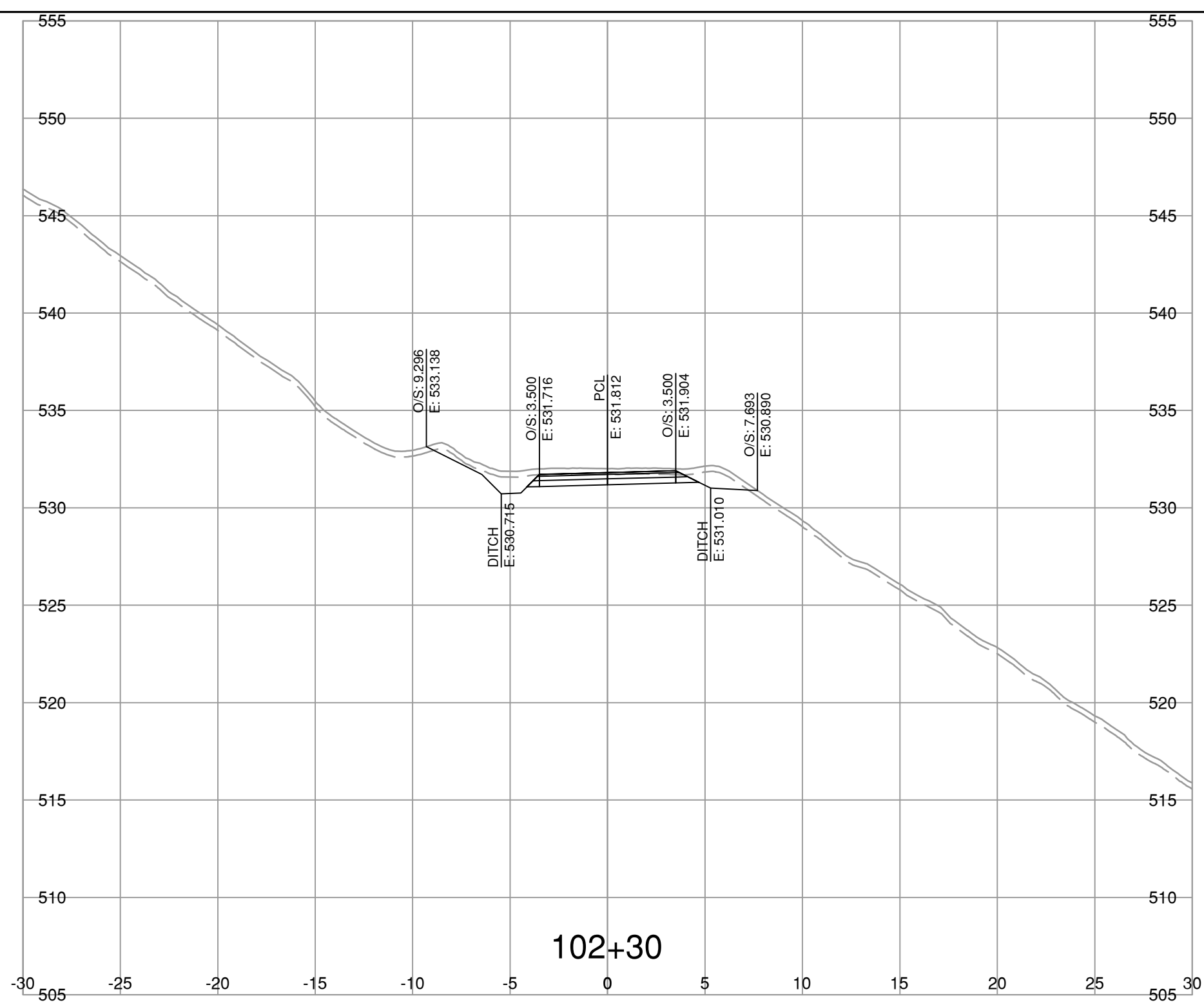
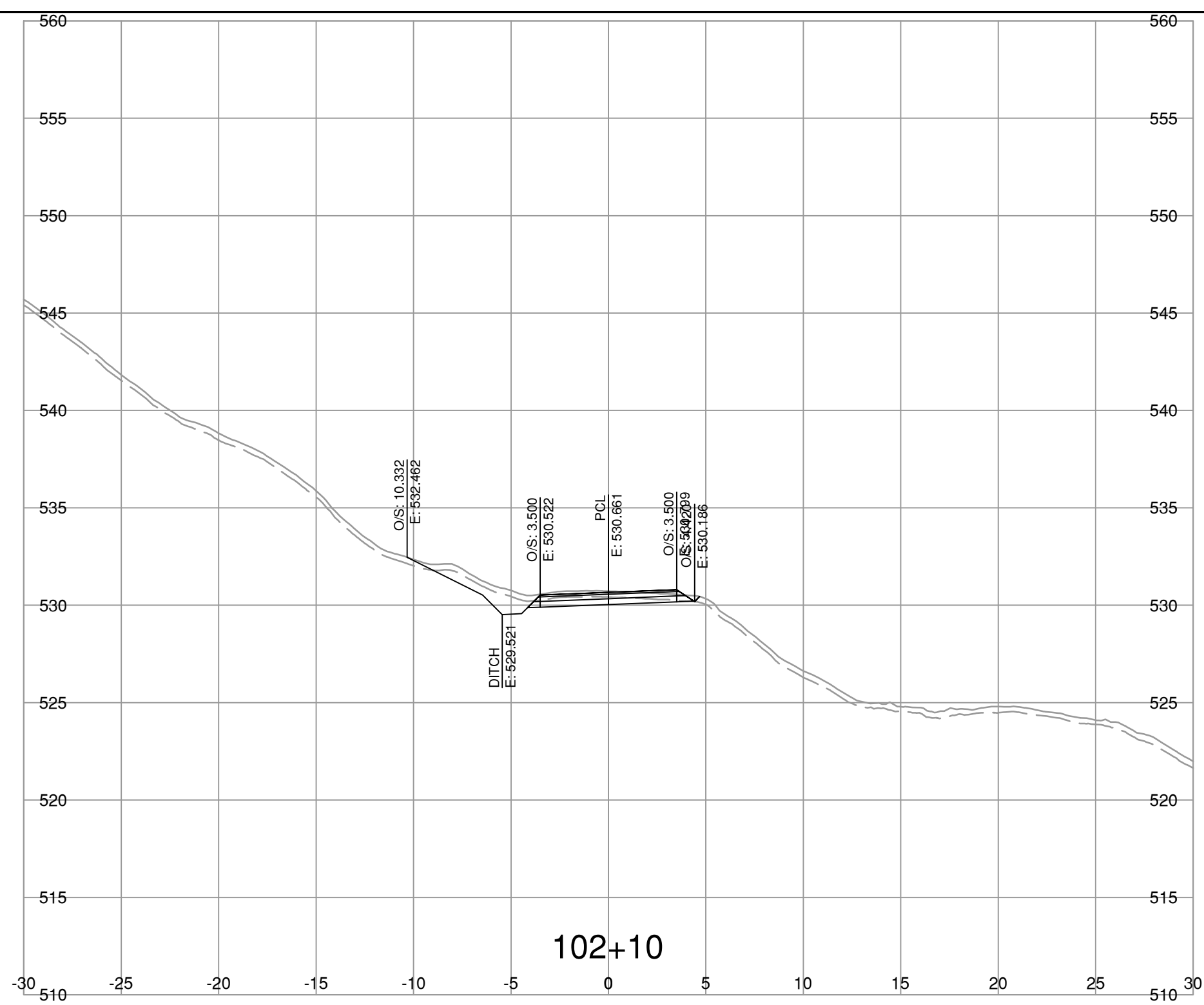
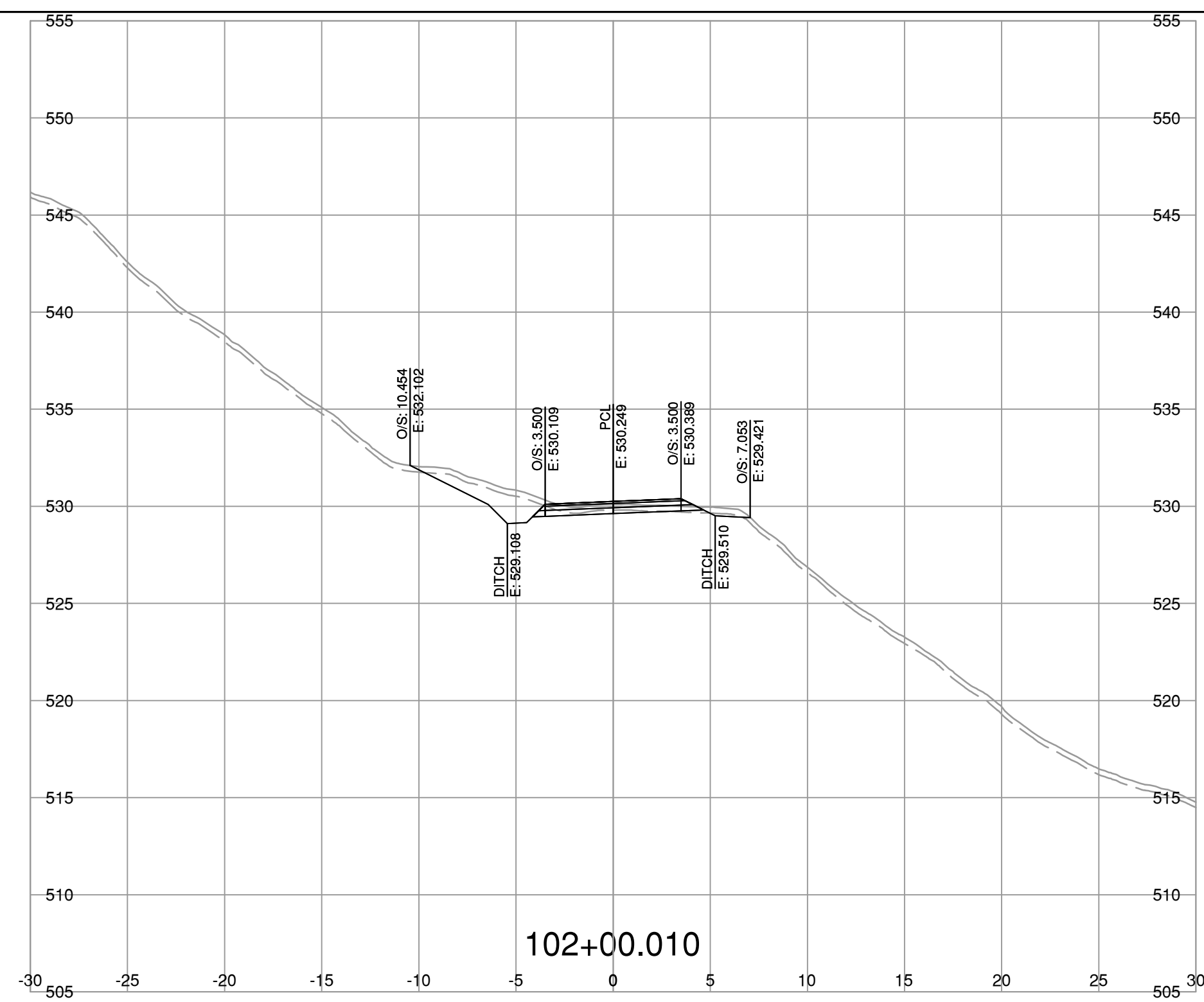
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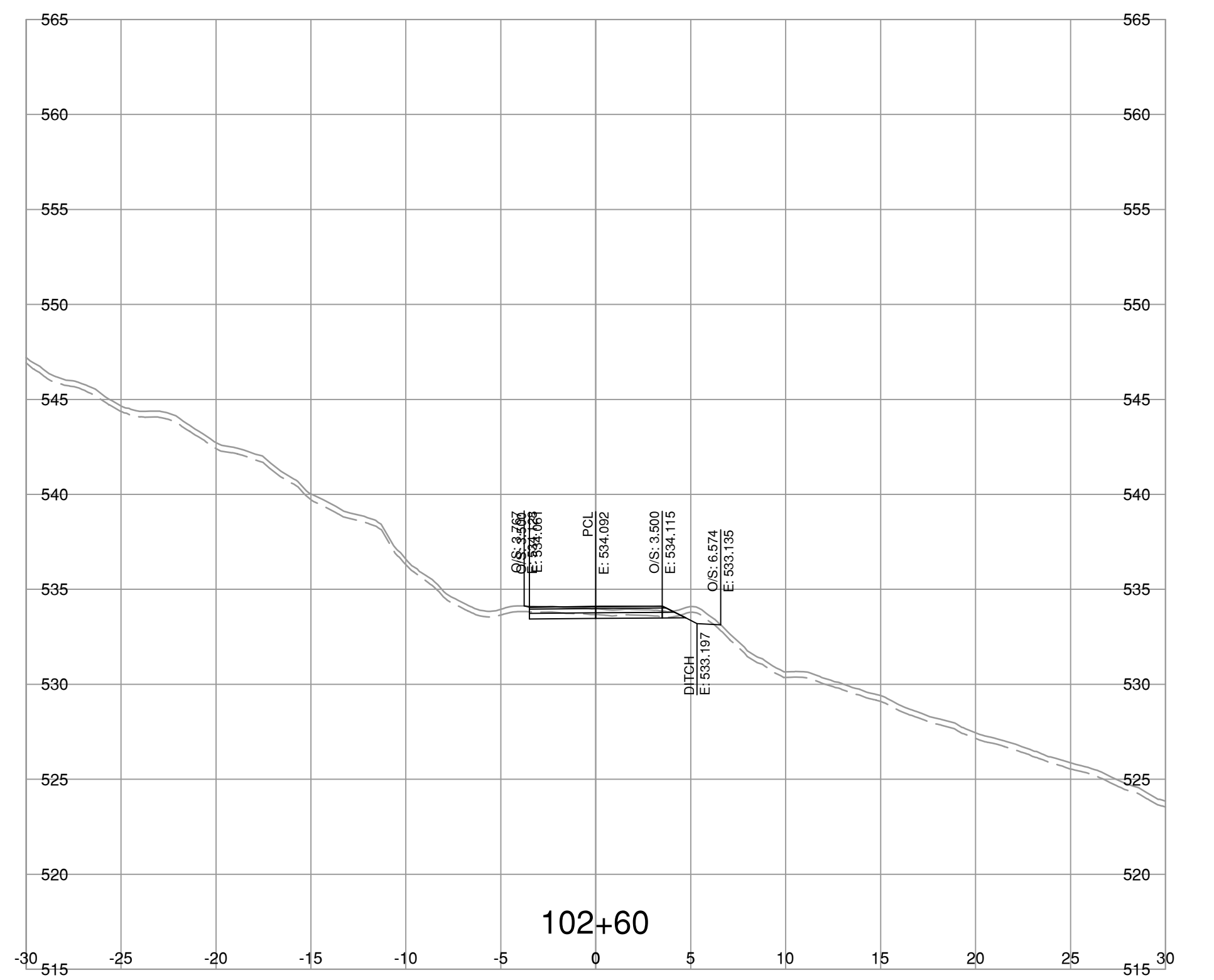
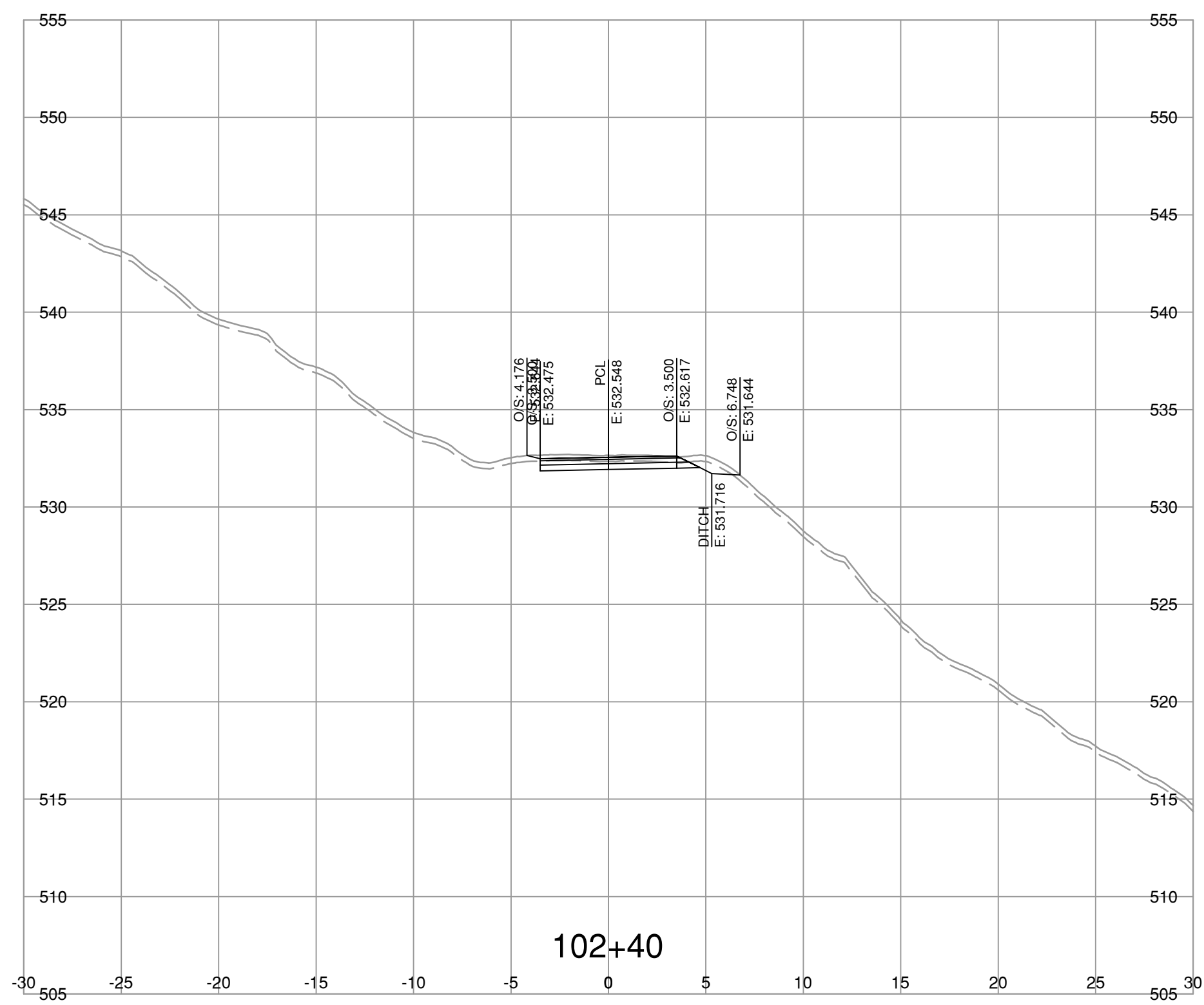
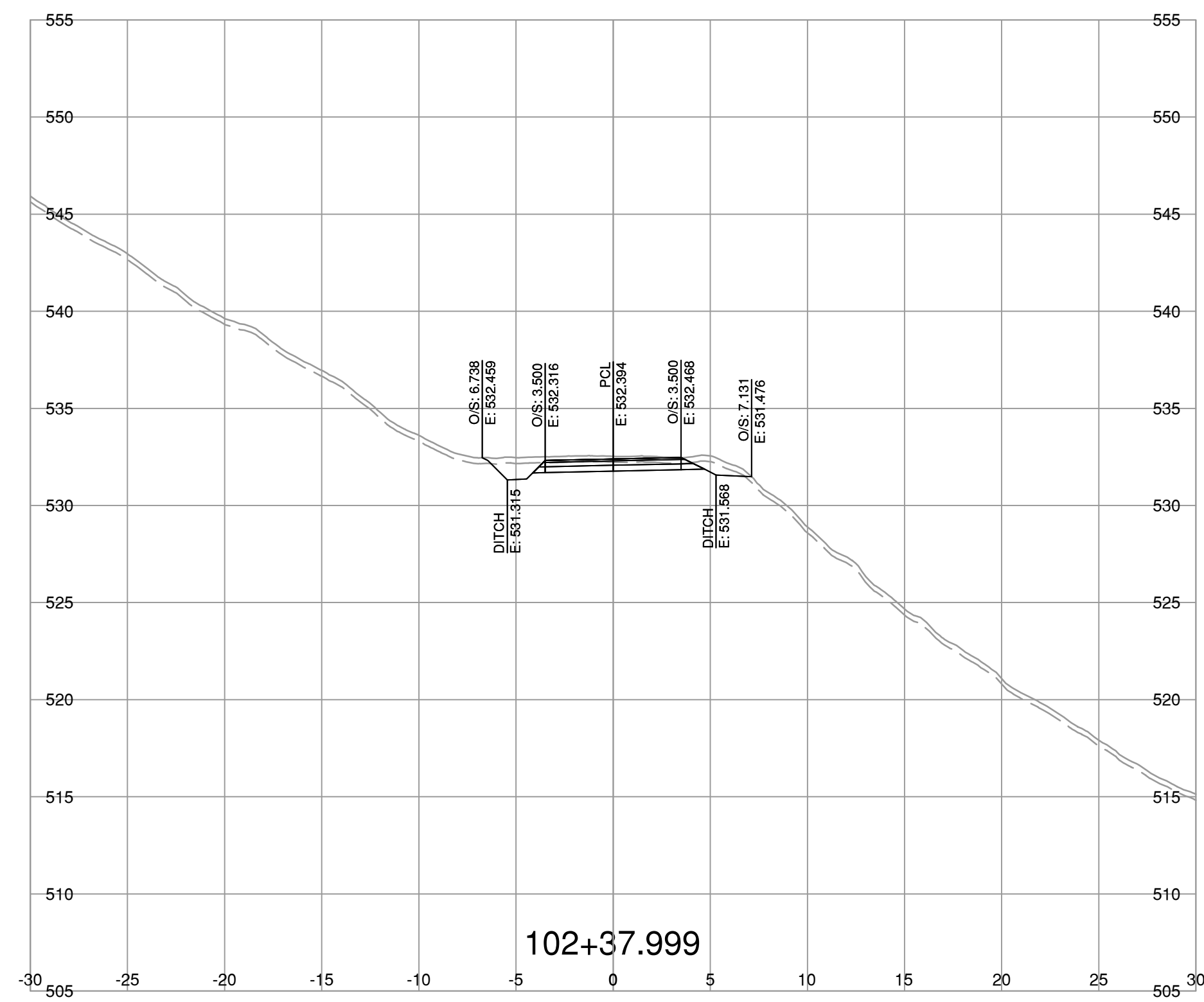
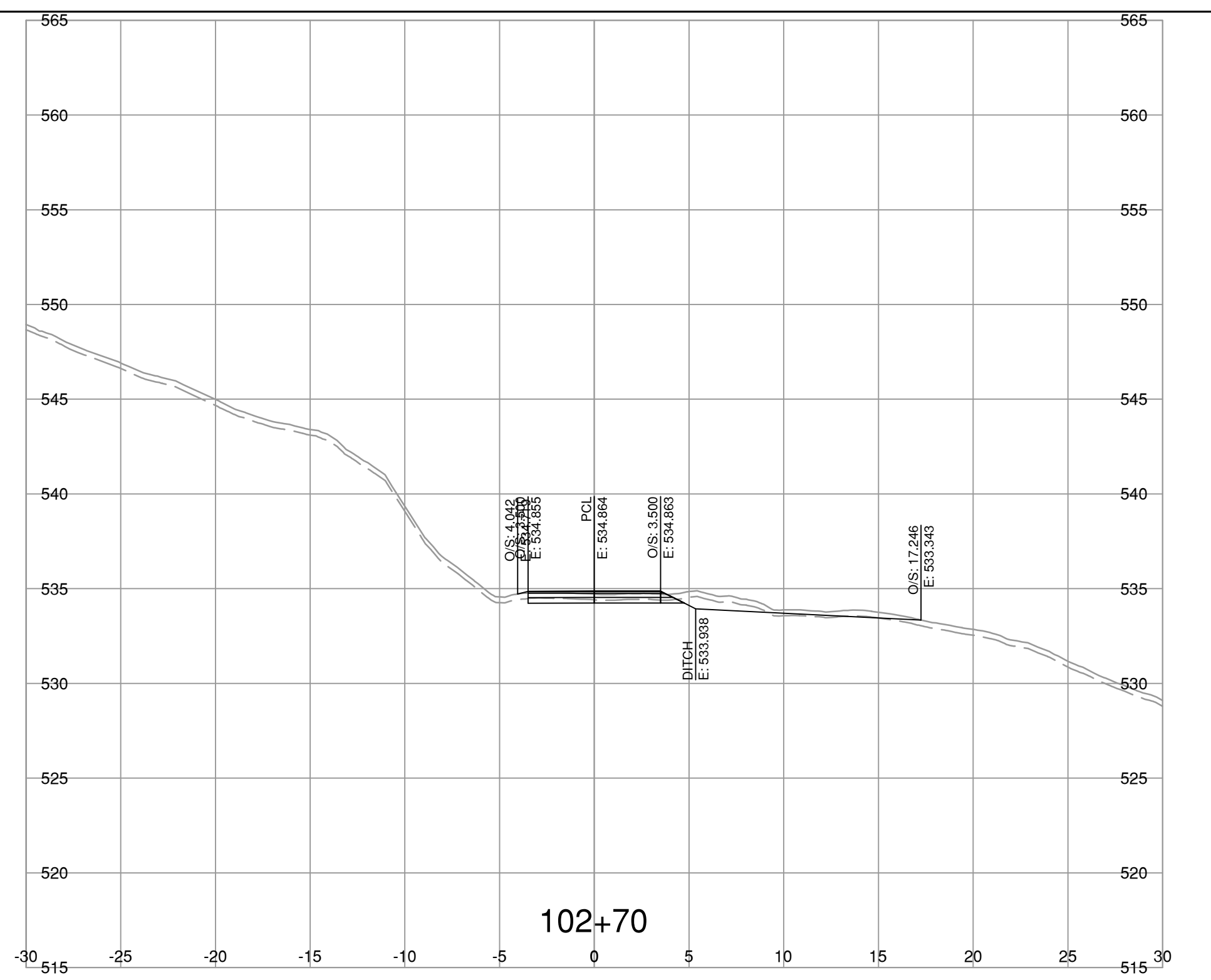
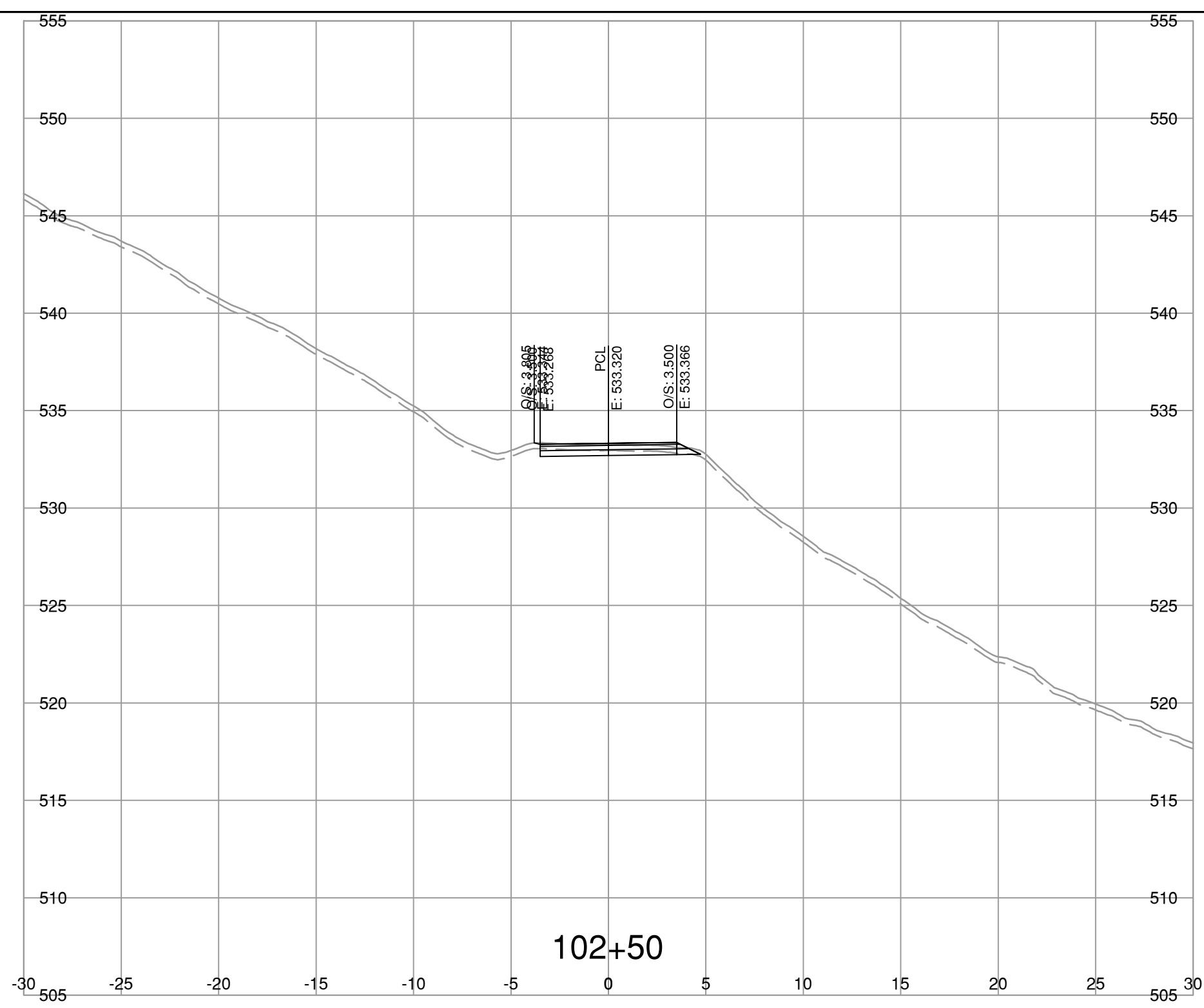
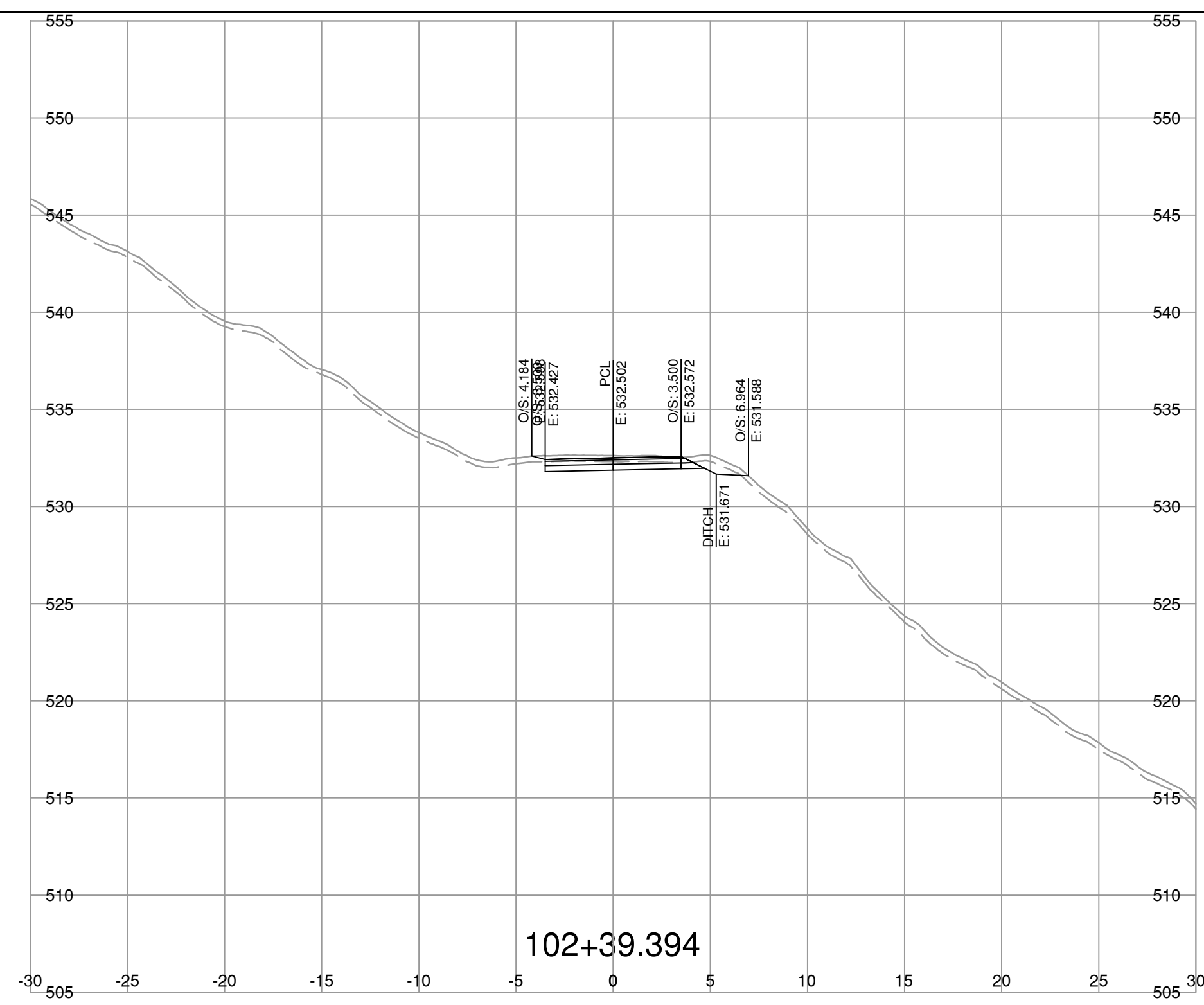
L100-LINE CROSS SECTIONS
AURUM ROAD WASHOUT
OPTION 2 - ROAD REALIGNMENT

SCALE

CAD FILENAME: SECT-4-100AS.DWG
DATE: 2023-03-23
FILE NUMBER: 22-0953

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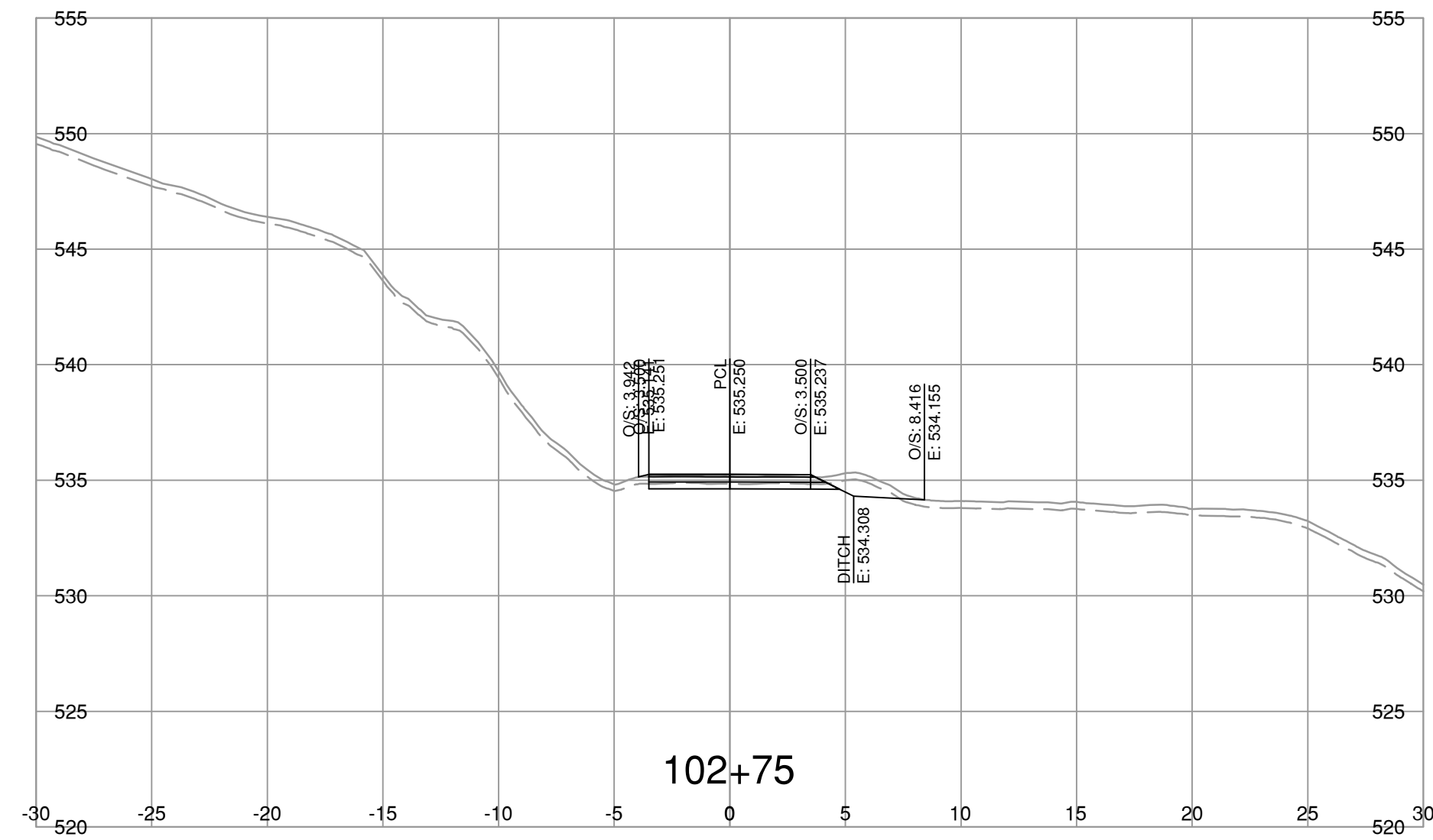
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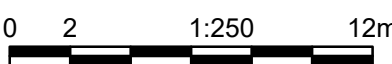


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