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LPPM
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Yogyakarta

Book of Abstract

LPPM UPN Veteran Yogyakarta International Conference Series 2021

Conference Theme:
"Sustaining Research Implication to Academic, Society, Government, and Industrial"

Virtual Conference
October 5-7, 2021

Supported by

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CONFERENCE CHAIR MESSAGE

We are delighted to welcome you to LPPM UPN Veteran Yogyakarta International Conference Series 2021: Engineering and Science Series (ESS) by LPPM Universitas Pembangunan Nasional Veteran Yogyakarta and Research Synergy Foundation (RSF) as official partner held virtually on October 5-7, 2021.

This conference not only give you global forum to share and exchange idea, research, and work. But also, provide wider network and research ecosystem for further collaboration and projects. We are glad to share this good opportunities in the scientific community, that will be offered only for all participants who participate in the conference.

The theme of conference is Sustaining Research Implication to Academic, Society, Government and Industrial. ESS 2021 International Conference shows up as a cutting-edge Engineering and Science research platform to gather presentations and discussions of recent achievements by leading researchers in academic research.

It has been our privilege to convene this conference. Our sincere thanks, to the conference organizing committee; to the Program Chairs for their wise advice and brilliant suggestion on organizing the technical program and to the Program Committee for their through and timely reviewing of the papers. Recognition should go to the Local Organizing Committee members who have all worked extremely hard for the details of important aspects of the conference programs and social activities.

We welcome you to this conference and hope that this year's conference will challenge and inspire you, and result in new knowledge, collaborations, and friendships.

Best regards,

Dr. Suranto, S.T., M.T

Conference Chair of
LPPM UPN Veteran Yogyakarta International Conference Series
Political and Social Science Series (PSS)

SESSION CHAIRS

Assoc. Prof. Dr. Mardeni Roslee

Multimedia Univeersity, Malaysia

Associate Professor Ts.Dr.Mardeni Roslee is a Deputy Director of Research Management Centre and an academician under Faculty of Engineering, Multimedia University, Cyberjaya, Malaysia. He is a President of MMU Mesra and Chairman of Centre of Wireless Technology, Multimedia University. At international level, he was a Chairman of IEEE Malaysia in Comsoc/VTS and Vice-Chair of Malaysian Radar & Navigations Interest Group (MyRaN ig), Malaysian Society for Engineering & Technology (MY SET). He is the Chief Executive Officer, main founder of Armada Smart Tech MR Sdn Bhd. He is a registered Chartered Engineer with Engineering Council United Kingdom, IET, UK. His current research interests are 5G/6G telecommunication, D2D, satellite, Internet of Things and radar communication. He has been invited at international conference as an invited speaker at Thailand, China, Australia, Korea, Indonesia, Singapore, Japan, French, United Kingdom, Spain, Canada, New Zealand and Romania. He has hold some international conference committees such as General Chair of DIFCON21, General Chair of IEEE ICECCE21, General Chair of IEEE MICC21, General Chair of ISTT20 and Conference Chair of IEEE MICC2019. He is the International keynote speaker for GECOST21, WWRF21, ICECCE21, IAICDE-20, ICECCE20, IEEE SOFTT19, I3CPE'19 and MyTENS16. His contributions to academic and the engineering professional over the years have earned him recognitions nationally and internationally, he has awarded 45 international/local awards including the University Excellent Researcher Award for 2016 and 2018, VTS Chapter of the Year Award 2017 from Canada, Excellence in European Creativity Special Award 2018 from Romania, World Invention Special Award 2019 from WIIPA, Outstanding Researcher Award 2020 from VTS, USA and awarded Top Research Scientist in Malaysia 2020 from Academy of Science Malaysia (ASM).

Dr. Julenah Ag Nuddin, PhD, MMIC

Universiti Teknologi MARA, Malaysia

Julenah binti AG NUDDIN completed her PhD in Chemistry (Medicinal Plant Chemistry) from Universiti Teknologi MARA in 2015 and MSc in Chemistry (Natural Products Chemistry) from Universiti Malaysia Sabah in 2005. She has been teaching since 1996 and currently, she is a Senior Lecturer at Faculty of Applied Sciences, Universiti Teknologi MARA Sabah Branch. A registered Chemist since 2009, her focus is in analytical and organic chemistry thus, actively pursuing her research interests in medicinal and hyperaccumulating plants. In these endeavours, she is currently representing UiTM in Agromining World Network based in France. Additionally, she has formed a research interest group known as RIG CRBio for their work at Crocker Range Biosphere Reserve with Sabah Parks. These activities reflect her belief that Borneo has much to offer than meets the eye. In the duration of her career, she has been awarded with Anugerah Khidmat Cemerlang (2005 & 2006), Best Innovation (IID UiTM Sabah 2009, 2010), Silver Medal in (IID UiTM 2010) and Best Innovation (IID UiTM Sabah 2013) with her faculty members. She is married with six children.

Ts. Dr. Alexius Korom

Universiti Teknologi MARA, Malaysia

Dr. Alexius Korom is a Senior Lecturer in Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA at Kota Kinabalu, Sabah, Malaysia. He graduated in Bachelor of Biological & Agricultural Engineering and MSc Remote Sensing & GIS from Universiti Putra Malaysia, Selangor Darul Ehsan. He also graduated in PhD from University Malaysia Sabah in the application of remote sensing in forestry and agriculture fields. He obtained his Professional Technologist and Professional Geospatialist less than 5 years after graduating from PhD.

In university, Dr. Alex teaches subjects of Mechanization in Estate Operation and Principles in Agriculture as well as the Field Work Practical. His research interests are in biomass estimation, precision agriculture and mechanization. Specifically, he likes to explore the latest application of drone in the plantation including data collection and analysis as well as the mechanization aspect. He has published several papers in international journals and joined a network of established collaborators from Japan and France. Currently, he managed to secure an internal grant research to study the biomass estimation in Maliau Basin Forest. Despite of his patience in research, he is also a friend to his students in the faculty, acting as an Academic Advisor for Planting Industry Management's program.

Prof. Haw Su Cheng

Multimedia University, Malaysia

Su-Cheng Haw is a Professor at Faculty of Computing and Informatics, Multimedia University, where she leads several funded research. She is also the research center chairperson of Center for Web Engineering (CWE), which is multidisciplinary and encompasses diversify research from modeling and tools, implementation, testing and evaluation, and application in the areas such as Databases and Information Retrieval, Service Oriented Computing, IoT, e-Learning, and Statistical Analysis.
Her research interests include XML databases, data warehousing, semantic web & ontology, data modeling, and recommender system. She has published around 120 articles in reputable journals and conferences. She serves in several editorial boards and participated as technical committee member and reviewer boards for several international conferences and journals. Besides, she also received several ad-hoc invitations to review journal/ conference articles. She is currently a member of IEEE and MBOT professional membership.

Dr. Oktoviano Gandhi

Alva Energi, Indonesia

A prolific academic, a hands-on engineer, and a tenacious entrepreneur, Oktoviano Gandhi is the go-to person for issues related to Solar Energy and Power System.

On the research front, Okto has worked on the engineering aspects of solar cells and modules, all the way to analysing policies' impact on energy intensity. His scientific works have resulted in more than twenty international publications. Okto has also held positions in many top universities across the world, namely Yonsei University in South Korea, University of Sao Paulo in Brazil, Tsinghua University in China, and National University of Singapore in Singapore.Okto is the editor of "Sustainable Energy Solution for Remote Areas in the Tropics", a book published by Springer Nature under the series Green Energy and Technology.

Through Alva Energi, which he co-founded, Okto is channeling his expertise in solar energy, rural electrification, electricity grid planning, and energy policy to promote renewable energy development in Indonesia and Southeast Asia. His works and achievements have been recognised internationally: he was selected to be part of Global Young Scientists Summit, Leader of Tomorrow at St. Gallen Symposium, BP Advancing Energy Scholar, and One Young World Ambassador. Okto was featured in Vanity Fair 2020 Global Goals List, representing SDG7: Ensure access to affordable, reliable, sustainable and modern energy for all. Living in a permanent beta, Okto is always looking for opportunities to grow his expertise and impact both within and outside the Power and Energy industry.

Dr. Siow Chun Lim

Mulitimedia University, Malaysia

Ir. Dr. Siow Chun Lim received his Ph. D in Electrical Power Engineering from Universiti Putra Malaysia. He is currently a Senior Lecturer and the Programme Coordinator of the Bachelor of Electrical Engineering at Multimedia University, Malaysia. His research interest includes lightning risk assessment, electrical earthing material, sustainable energy and engineering education. He is the national expert representing Malaysia in the IEC TC 81 (Lightning Protection). He is currently the Deputy Chair of Electrical Engineering Technical Division, The Institution of Engineers Malaysia and is also the Honorary Secretary of the ASEAN Engineering Inspectors – Electrical Installation of the ASEAN Federation of Engineering Organisation. Back in November 2019, he founded a spinoff company (LiRESAS Pvt Ltd) which offers consultancy in the lightning risk assessment field. He is a professional electrical engineer registered with the Board of Engineers Malaysia and is also trained in Design Thinking.

Assoc. Prof. Ma. Ian P. De Los Trinos

Technological University of the Philippines

Ma. Ian P. De Los Trinos is an Associate Professor V of the Technological University of the Philippines, having served as a faculty member for 27 years. She is the Dean of the College of Industrial Technology for 5 years now and has served as the College Secretary for 7 years and the Head of the Electronics Engineering Technology Department for 2 years. She has published several researches in recognized Scopus Journals. Her research interests are in the fields of computer engineering, artificial intelligence, educational technology, and industrial technology. She is an active member of the Philippines Association of Colleges and Universities in Industrial Technology (PACUIT).

Engr. Christopher C. Mira

Engr. Mira is a graduate of B.S. Industrial Engineering and has been a Master in Industrial Engineering and Management. He has been with the university as a fulltime assistant professor since November 2006 initially handling major Industrial Engineering subjects. Later in 2017, he has been given subjects in Quality Management for BS Accountancy and BS Business Administration Major in Human Resource Management. His involvement in research has been commended during his being a member of the University Research Group for Engineering, Architecture and Technology Colleges. He has presented various research papers in the local and international settings likewise, invited as panelist and session chair in various research presentations. He is also regularly invited by some business establishments reference to their quality and performance evaluation. He is presently the adviser of the Phil. Inst. of Ind'l. Engineers (PIIE) PUP Binan Chapter and former adviser of the Manila Innovators and Dev't. Society (MINDS). Engr. Mira is a member of several groups involving research peer evaluation, scholarly research.

Ersan Yudhapratama Muslih

Ersan Y. Muslih is a researcher and staff member at Mechanical Engineering Department, Trisakti University. He got a master's degree in material science and engineering from Yeungnam University, South Korea. He is currently is a Ph.D. student at Material Chemistry Division, Natural Science and Technology, Kanazawa University, Japan. His research interest is about materials, photovoltaic and renewable energy. His current research is about kesterite and perovskite solar cells and had several publications on it.

Tuesday, October 5th, 2021

Time (UTC+7)	*Dur'*	*Activity*
Main Room		
7:50 - 8:00	0:10	**Participant Login and Join Virtual Conference by ZOOM**
8:00 - 8:10	0:10	Welcome Address and Conference Publication Announcement by MC
8:10 - 8:20	0:10	Listening the national anthem "Indonesia Raya" and "Bela Negara"
8:20 - 8:30	0:10	**Welcome Remarks and Introduction** **of LPPM UPN Conference Series 2021** **Dr. Dyah Sugandini, SE, M.Si** **Chief of LPPM UPN Conference Series 2021**
8:30 - 8:40	0:10	**Opening Speech** **Dr. Irhas Effendi, MS.** **Rector of UPN "Veteran" Yogyakarta**
8:40 - 8:50	0:10	**Global Research Ecosystem Introduction** **Dr. Hendrati Dwi Mulyaningsih** **Founder & Chairman of Research Synergy Foundation**
8:50 - 9:40	0:50	**Keynote Speaker** **Prof. Ir. Nizam, M.Sc., DIC, Ph.D., IPU, Asean Eng.** **Directorate General of Higher Education (Dirjen Dikti) of Education and Culture Ministry, Indonesia**
9:40 - 9:45	0:05	Token of Appreciation for Keynote Speakers
9:45 - 9:50	0:05	E-Group Photo
9:50 - 10:30	0:40	**Keynote Speaker** **Prof. Dr. Zulfadzli Bin Yusoff** **RMC Director / Professor, Faculty of Engineering (FOE),** **Multimedia University, Malaysia**
10:30 - 11:10	0:40	**Keynote Speaker** **Dr. Hendro Widjanarko, SE., MM.** **Chief of LPPM UPN "Veteran" Yogyakarta, Indonesia**
11:10 - 11:50	0:40	**Keynote Speaker** **Prof. Dr. Theresita V. Atienza** **President of Quezon City University, Philippines**
11:50 - 11:55	0:05	Token of Appreciation for Keynote Speakers
11:55 - 12:00	0:05	**Announcement of Parallel Online Presentation Session**
12:00 - 13:00	1:00	Break & Go To Parallel Rooms
Breakout Room		**Economic and Business Series (EBS),** **Political and Social Science Series (PSS), &** **Engineering and Science Series (ESS)**
13:00 - 13:10	0:10	Session Chair Introduction

Time (UTC+7)	*Dur'*	*Activity*
13:10 - 15:10	2:00	**Online Presentation Session Day 1:** **8 person/room** **15 minutes/presenter**
15:10 - 15:30	0:20	Awarding Certificate of Presentation, Testimonial, and Post-conference information announcement
Main Room		
15:30 - 15:45	0:15	Short break and preparation for closing
15:45 - 15:55	0:10	**Awarding Ceremony** Best Presentation Session Chair
15:55 - 16:00	0:05	**Closing of Day 1 and Announcement**

Wednesday, October 6th, 2021

Time (UTC+7)	*Dur'*	*Activity*
Main Room		
8:50 - 9:00	0:10	**Participant Login and Join Virtual Conference by ZOOM**
9:00 - 9:05	0:05	Welcome Address and Conference Publication Announcement by MC
9:05 - 9:10	0:05	**Welcome Remarks** **Dr. Hendro Widjanarko, SE., MM.** **Economics and Business Series – Conference Chair**
9:10 - 9:15	0:05	**Welcome Remarks** **Prayudi, M.A., Ph.D** **Political and Social Science Series – Conference Chair**
9:15 - 9:20	0:05	**Welcome Remarks** **Dr. Suranto, S.T., M.T** **Engineering and Science Series – Conference Chair**
9:20 - 9:25	0:05	Token of Appreciation for Conference Chairs of EBS, PSS, ESS
9:25 - 9:30	0:05	E-Group Photo
Breakout Room		**Economic and Business Series (EBS),** **Political and Social Science Series (PSS), &** **Engineering and Science Series (ESS)**
9:30 - 9:40	0:10	Session Chair Introduction
9:40 - 11:40	2:00	**Online Presentation Day 2, Session 1:** **8 person/room** **15 minutes/presenter**
11:40 - 12:00	0:20	Awarding Certificate of Presentation, Testimonial, and Post-conference information announcement
12:00 - 13:00	1:00	Break
13:00 - 13:10	0:10	Session Chair Introduction
13:10 - 15:10	2:00	**Online Presentation Day 2, Session 2:** **8 person/room** **15 minutes/presenter**
15:10 - 15:30	0:20	Awarding Certificate of Presentation, Testimonial, and Post-conference information announcement
Main Room		
15:30 - 15:45	0:15	Short break and preparation for closing
15:45 - 15:55	0:10	**Awarding Ceremony** Best Presentation Session Chair
15:55 - 16:00	0:05	**Closing of Day 2 and Announcement**

Thursday, October 7th, 2021

Time (UTC+7)	*Dur'*	*Activity*
Main Room		
8:50 - 9:00	0:10	**Participant Login and Join Virtual Conference by ZOOM**
9:00 - 9:05	0:05	Welcome Address and Conference Publication Announcement by MC
9:05 - 9:10	0:05	**Welcome Remarks** Dr. Dyah Sugandini, SE, M.Si Chief of LPPM UPN Conference Series 2021
9:10 - 9:15	0:05	E-Group Photo
Breakout Room		**Economic and Business Series (EBS),** **Political and Social Science Series (PSS), &** **Engineering and Science Series (ESS)**
9:15 - 9:25	0:10	Session Chair Introduction
9:25 - 11:40	2:15	**Online Presentation Day 3, Session 1:** **9 person/room** **15 minutes/presenter**
11:40 - 12:00	0:20	Awarding Certificate of Presentation, Testimonial, and Post-conference information announcement
12:00 - 13:00	1:00	Break
13:00 - 13:10	0:10	Session Chair Introduction
13:10 - 15:10	2:00	**Online Presentation Day 3, Session 2:** **8 person/room** **15 minutes/presenter**
15:10 - 15:30	0:20	Awarding Certificate of Presentation, Testimonial, and Post-conference information announcement
Main Room		
15:30 - 15:45	0:15	Short break and preparation for closing
15:45 - 15:55	0:10	**Awarding Ceremony** Best Presentation Session Chair Best Paper
15:55 - 16:00	0:05	**Closing Ceremony**

Track Energy

Well Design Profile Directional Drilling Cluster System in Offshore Platform

Herianto,PhD[1], Deshinta Putri H, P[2]. Subiatmono[3]

[1]Assoc. Prof, Petroleum Engineering Dept. UPN Veteran Yogyakarta Indonesia

[2]Repsol Sakakemang, Exploration, Student Magister Petroleum Engineering, UPN Veteran, Yogyakarta

[3]Senior Lecture Petroleum Engineering Dept. UPN Veteran Yogyakarta Indonesia

Abstract

HK Field Drilling is an offshore drilling that is planned in the form of a cluster where there are 4 target wells with well distances that are close to each other and the target points spread with different azimuth directions. In this study, there are 4 directional drilling wells that will be planned, namely "A1, A2, A3 & A4" on a production platform with a fixed platform rig type. Drilling was carried out in shallow water with a depth of 80 ft, Conductor Casing depth of 100 ft with a KOP (Kick Off Point) depth of 250 ft TVD/MD, and the distance between the platform to the target point as far as 2500 ft TVD with an estimated drain radius of 250 ft.

This research was conducted to calculate the depth of End of Build, Measured Depth Target, Horizontal Departure and Casing Setting Depth in each well. In this case study, the radius of curvature method is used to determine the length of the vertical section, build up section and tangential section. After calculating, it is known that well A1 has an inclination angle of 31o with an azimuth direction of N53oE. well A2 has an inclination angle of 31o with an azimuth direction of N162oE. well A3 has an inclination angle of 31o with an azimuth direction of N219oE. well A4 has an inclination angle of 31o with an azimuth direction of N323oE.

Keywords: Directional drilling, well profile, cluster system offshore, shallow sea

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LPPM UPN Veteran Yogyakarta International Conference Series 2021

Political and Social Science Series

Well Design Profile Directional Drilling Cluster System in Offshore Platform

Herianto,PhD[1], Deshinta Putri H[2], P. Subiatmono[3]

[1]*Assoc. Prof, Petroleum Engineering Dept. UPN Veteran Yogyakarta Indonesia*
[2]*Repsol Sakakemang, Exploration, Student Magister Petroleum Engineering, UPN Veteran, Yogyakarta*
[3]*Senior Lecture Petroleum Engineering Dept. UPN Veteran Yogyakarta Indonesia*

I. Abstract

HK Field Drilling is an offshore drilling that is planned in the form of a cluster where there are 4 target wells with well distances that are close to each other and the target points spread with different azimuth directions. In this study, there are 4 directional drilling wells that will be planned, namely "A1, A2, A3 & A4" on a production platform with a fixed platform rig type. Drilling was carried out in shallow water with a depth of 80 ft, Conductor Casing depth of 100 ft with a KOP (Kick Off Point) depth of 250 ft TVD/MD, and the distance between the platform to the target point as far as 2500 ft TVD with an estimated drain radius of 250 ft.

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Keywords: Directional drilling, well profile, cluster system offshore, shallow sea

II. Introduction

Directional drilling is a drilling technique in which the drilling trajectory is deflected following a planned trajectory towards a certain direction to reach a predetermined target below the earth's surface. Initially, directional drilling was used to correct the deflection that occurred in vertical wells. However, along with its development, directional drilling is increasingly being applied such as sidetrack drilling, relief wells, horizontal wells, offshore drilling from one drilling platform, and drilling where vertical drilling cannot be carried out due to the influence of natural conditions. The factors that cause directional drilling are due to surface conditions, geological reasons, economics, and other reasons. So directional drilling is only carried out for special reasons and circumstances.

As the cost of developing reserves increases, the need for directional drilling will also increase. Drilling with a cluster system is needed to drill a formation that is located on a surface that is limited in area. The implementation of multilateral drilling is carried out and can be economically justified, considering that the implementation of this drilling technique requires expensive costs.

In determining the drill hole trajectory, it is very important to design directional and horizontal drilling. Especially in the case of multi-well platforms where a number of aspects must be carefully examined before designing the final well path to the target. In well track design, targets are usually determined by a geologist with acceptable tolerances. To reach the target, the target zone should be selected as large as possible. If more than one zone is reached, the designed drilling trajectory must be reasonable and achievable without causing drilling problems.

In this drilling operation, directional drilling will be carried out in the offshore field. The drilling is planned to be in the form of a cluster with 4 wells on a fixed platform type. The purpose of this drilling by planning 4 wells in 1 cluster is to save the use of small land and also to facilitate control if 1 cluster is made on 1 platform. Another objective is to drain hydrocarbons believed to be within a radius of 250 ft. Then the drainage plan will be made to have 4 different directions from each well. The determination of the KOP in the planning of this drilling operation will be carried out with a shallow deviation type because to avoid potential interference problems between wells if it is carried out at deep deviation.

III. Literature Review

Well trajectory design in directional drilling can be done by calculating the directional coordinates of directional drilling wells. After that, calculate the true vertical depth (TVD) vertical section, true vertical depth in the EOB section total depth (TD), and horizontal departure. Methods that can be used in designing well trajectory, such as methods: tangential, balanced tangential, average angle, radius of curvature and minimum of curvature (Farah Omar Farah, 2014). This paper discusses well trajectory design planning using the radius of curvature method and well trajectory design calculations using the Bourgoyne equation. In planning the well trajectory of directional drilling wells, it is necessary to take into account the azimuth angle, build up rate angle, TVD length, horizontal displacement length, KOP, total length MD. Well trajectory calculation method using the radius of curvature method. Calculations are done manually and by using the Microsoft Excel and Compass programs and then compared. The results obtained are the results of calculations using the Compass program are closer to manual calculations compared to excel (Krishnan, 2016). However, in the writing of this paper, the calculations are only done manually and using Microsoft Excel. In determining the drill hole trajectory, it is very important to design directional and horizontal drilling. Especially in the case of multi-well platforms where a number of aspects must be carefully examined before designing the final well path to the target. In well track design, targets are usually determined by a geologist with acceptable tolerances. To reach the target, the target zone should be selected as large as possible. If more than one zone is reached, the designed drilling trajectory must be reasonable and achievable without causing drilling problems (Halafawi, 2019). In cluster drilling clusters offshore directional drilling, the depth or depth of the well affects the economy, especially in reducing the cost of building and constructing the platform line (Pfau, 1969). Well design planning with shallow kick off points can also reduce the maximum inclination angle (Chewaroungroaj, 2021).

In shallow sediments, unlike deep sediments with elastic behavior, the failure mechanism of the casing shoe is strongly affected by the plasticity of the rock. Hence, the common practice in casing design which is based on using the pore pressure and fracture pressure gradients plots is not applicable in shallow sediments. In general, casing design, like any other design process, should be justified and planned in advance. An optimal design solution is sought, by finding the best compromise to satisfy the design requirements. The factors considered for a casing design based on the well control issues include: Casing shoe depth, Hole size, Kick volume, Mud weight For a constant well geometry, as the depth increases, there would be a linear increase in the casing shoe failure pressure (Paknejad et al, 2009).

IV. Research Methodology

In this plan, the radius of curvature method is used to determine the length of the trajectory in the build up section and the tangential method is used to determine the length of the trajectory in the tangential section.

Build and Hold (J-Shaped) Well Profile:

In the vertical section, calculations are carried out to find the azimuth angle and determine the KOP point. The KOP point is determined from the data, while to find the azimuth angle, the equation from Bourgoyne is used as in equation (1):

$$\alpha = \tan^{-1}\left(\frac{x}{y}\right) \tag{1}$$

In the Build up section, calculations are carried out to find the length of the radius of curvature in equation (2), the maximum inclination angle in equations (3) & (4), the length of the measured depth (MD) using equation (5), the length of the TVD using equation (6), and horizontal displacement in the build up section using equation (7):

$$r1 = \frac{180}{\pi x BUR} \tag{2}$$

if $r1 > X_3$

$$\theta = \arctan\left(\frac{TVD_3 - TVD_1}{r1 - X_3}\right) - \arccos\left(\left(\frac{r1}{TVD_3 - TVD_1}\right) x \sin\left(\arctan\left(\frac{TVD_3 - TVD_1}{r1 - X_3}\right)\right)\right) \tag{3}$$

Or

if r1 < X_3

$$\theta = 180 - \arctan(\frac{TVD_3 - TVD_1}{r1 - X_3}) - \arccos((\frac{r1}{TVD_3 - TVD_1}) x \sin(\arctan(\frac{TVD_3 - TVD_1}{r1 - X_3}))) \quad (4)$$

$$MD_2 = \frac{\theta}{BUR} \quad (5)$$

$$TVD_2 = r1 \times \sin\theta + TVD_1 \quad (6)$$

$$X_2 = r1 \times (1 - \cos\theta) \quad (7)$$

In the Tangential section, calculations are carried out to find the length of the measured depth tangent section in equation (8), TVD in the tangent section in equation (9), horizontal length in the tangential section in equation (10) and the total measured depth in equation (13):

$$MD_3 = \frac{TVD_3 - TVD_2}{\cos\theta} \quad (8)$$

$$TVD_3 - TVD_2 = MD_3 \times \cos\theta \quad (9)$$

$$X_3 - X_2 = (MD_3 \times \sin\theta) \quad (10)$$

$$TMD = MD_1 + MD_2 + MD_3 \quad (11)$$

Table 1.
Directional Drilling Well Profile Parameters

Vertical Section	**Build Up Section**	**Tangential Section**
Surface Location Point	*Kick off Point* (KOP)	*Tangential Inclination*
Kick off Point (KOP)	*Build Up Rate* (BUR)	TVD Tangential
TVD *Vertical Section*	*Radius of Curvature* (r1)	*Measured Depth* Target
Measured Depth Vertical Section	Maximum Inclination	*Horizontal Displacement* Target
	TVD *Build Up Section*	
	Measured Depth Build Up Section	
	Horizontal Displacement Build Up Section	

V. Results & Discussion

In this study, data obtained from one directional drilling platform is used to plan the well profile and hole geometry of each well in this 1 cluster. And also will determine the azimuth direction of each well profile will be planned.

1. Well Profile A1

   Well A1 is a J-Shaped directional drilling well with a target depth of 2500 ftTVD/2557 ftMD with a KOP of 300 ftTVD/MD. In planning the profile of the A1 well, it will consist of 3 sections, namely, a vertical section at a depth of 0-300 ft, a build up section at a depth of 300-560 ftMD, and a Tangential section at a depth of 560-2557 ftMD. The vertical section consists of 2 drilling routes, namely the conductor casing route using a 20" OD casing at a depth of 0-100 ft and a surface casing route using a 13⅜" OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-560 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 560-2557 ftMD. In the A1 well, the azimuth direction is N53^{o}E with a maximum inclination angle of 31^o.

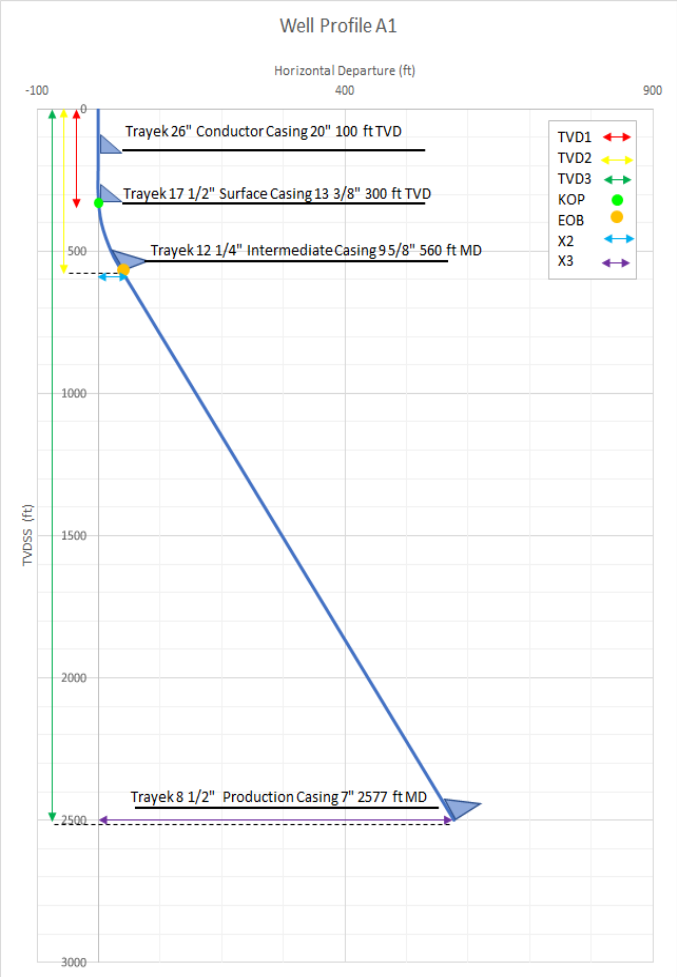

Figure 1. Well Profile A1

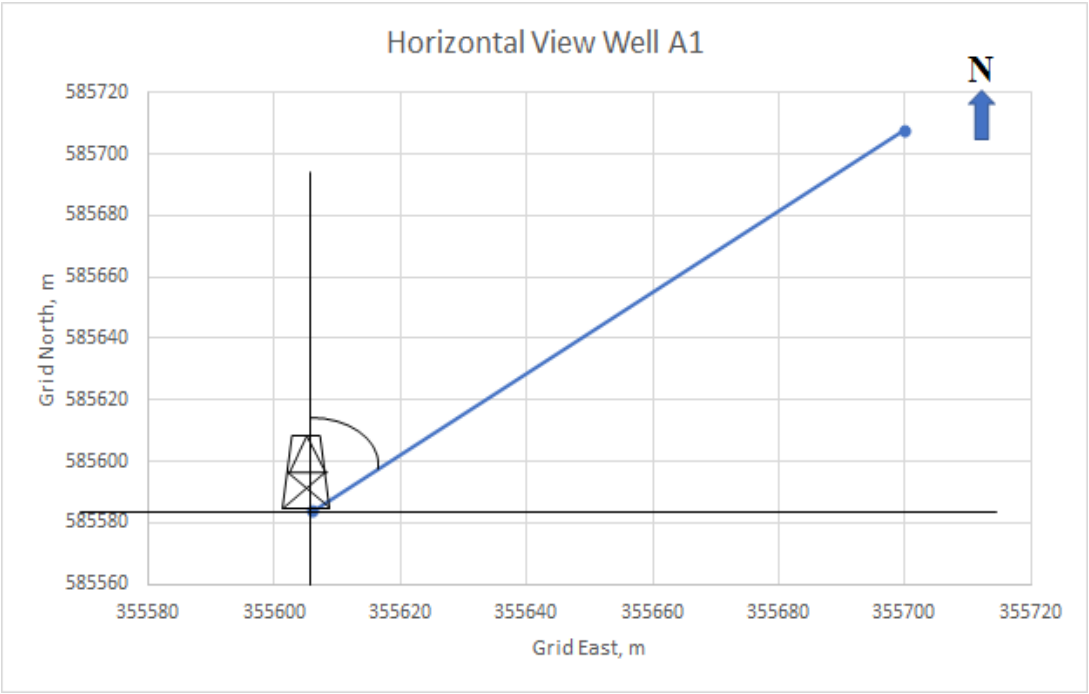

Figure 2. Horizontal View Well A1

Table 2.
Parameter of Well Profile A1

Section	Drilling Trajectory	Bit Size	OD Casing	Length Casing	BUR	MD (ft)	TVD (ft)	H (ft)	θ
Vertical Section (0-300 ft)	Conductor Casing (0-100 ft)	26”	20”	100 ft	0º	100	100	0	0º
	Surface Casing (100-300ft)	17½”	13⅜”	300 ft	0º	200	300	0	0º
Build Up Section (300 – 560 ftMD)	Intermediate Casing 300 –560 ftMD	12¼”	9⅝”	560 ft	6º /100 ft	260	556	35	N53ºE
Tangential (560 –2557 ftMD)	Production Casing 560–2557 ftMD	8½”	7”	2557 ft	0º	2003	2500	518	N53ºE

2. Well Profile A2

Well A2 is a J-Shaped directional drilling well with a target depth of 2500 ftTVD/2575 ftMD with a KOP of 300 ftTVD/MD. In planning the profile of the A2 well, it will consist of 3 sections, namely, a vertical section at a depth of 0-300 ft, a build up section at a depth of 300-557 ftMD, and a Tangential section at a depth of 557-2575 ftMD. The vertical section consists of 2 drilling routes, namely the conductor casing route using a 20” OD casing at a depth of 0-100 ft and a surface casing route using a 13⅜” OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-557 ftMD. And the tangential section has 1 route, namely the production casing route using a 7” OD casing at a depth of 557-2575 ftMD. In well A2, the azimuth direction is N162ºE with a maximum inclination angle of 31º.

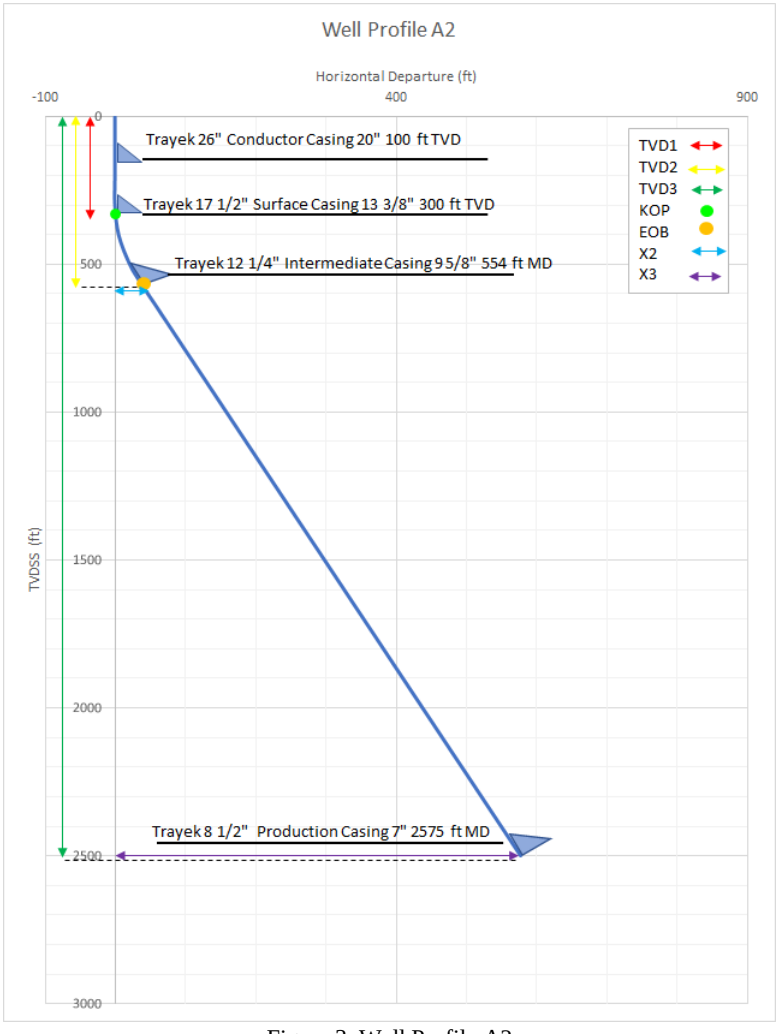

Figure 3. Well Profile A2

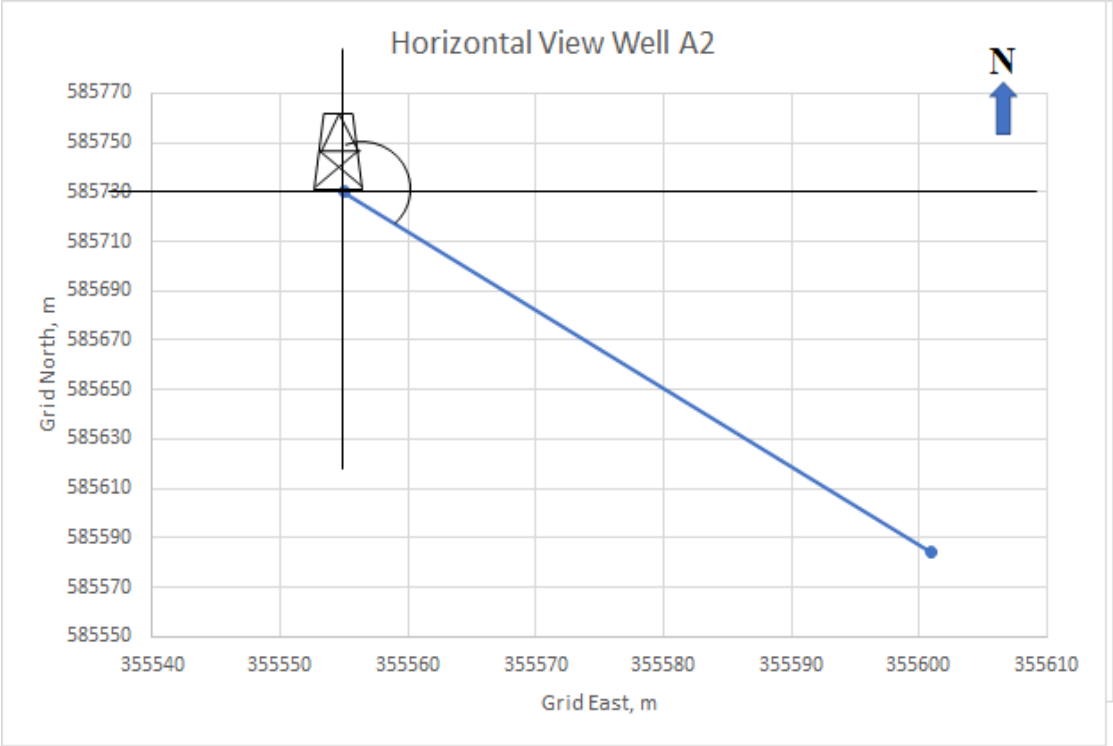

Figure 4. Horizontal View Well A2

Table 3
Parameter of Well Profile A2

Section	Drilling Trajectory	Bit Size	OD Casing	Length Casing	BUR	MD (ft)	TVD (ft)	H (ft)	θ
Vertical Section (0-300 ft)	Conductor Casing (0-100 ft)	26”	20”	100 ft	0º	100	100	0	0º
	Surface Casing (100-300ft)	17½”	13⅜”	300 ft	0º	200	300	0	0º
Build Up Section (300 – 557 ftMD)	Intermediate Casing 300 –557 ftMD	12¼”	9⅝”	557 ft	6º /100 ft	257	554	34	N162ºE
Tangential (557 –2575 ftMD)	Production Casing 557–2575 ftMD	8½”	7”	2575 ft	0º	2018	2500	502	N162ºE

3. Well Profile A3

Well A3 is a J-Shaped directional drilling well with a target depth of 2500 ftTVD/2577 ftMD with a KOP of 300 ftTVD/MD. The A3 well profile will consist of 3 sections, namely, a vertical section at a depth of 0-300 ft, a build up section at a depth of 300-560 ftMD, and a Tangential section at a depth of 560-2577 ftMD. The vertical section consists of 2 drilling routes, namely the conductor casing route using a 20” OD casing at a depth of 0-100 ft and a surface casing route using a 13⅜” OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-560 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 560-2577 ftMD. In the A3 well, the azimuth direction is N219oE with a maximum inclination angle of 31o.

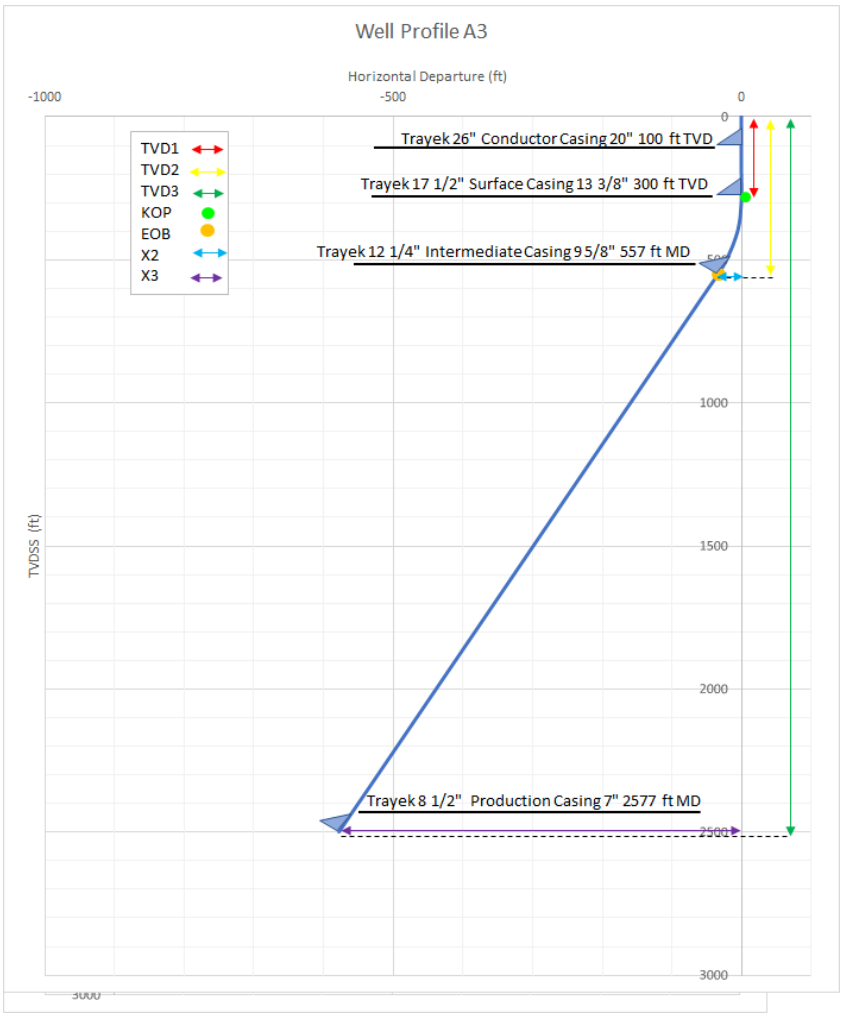

Figure 5. Well Profile A3

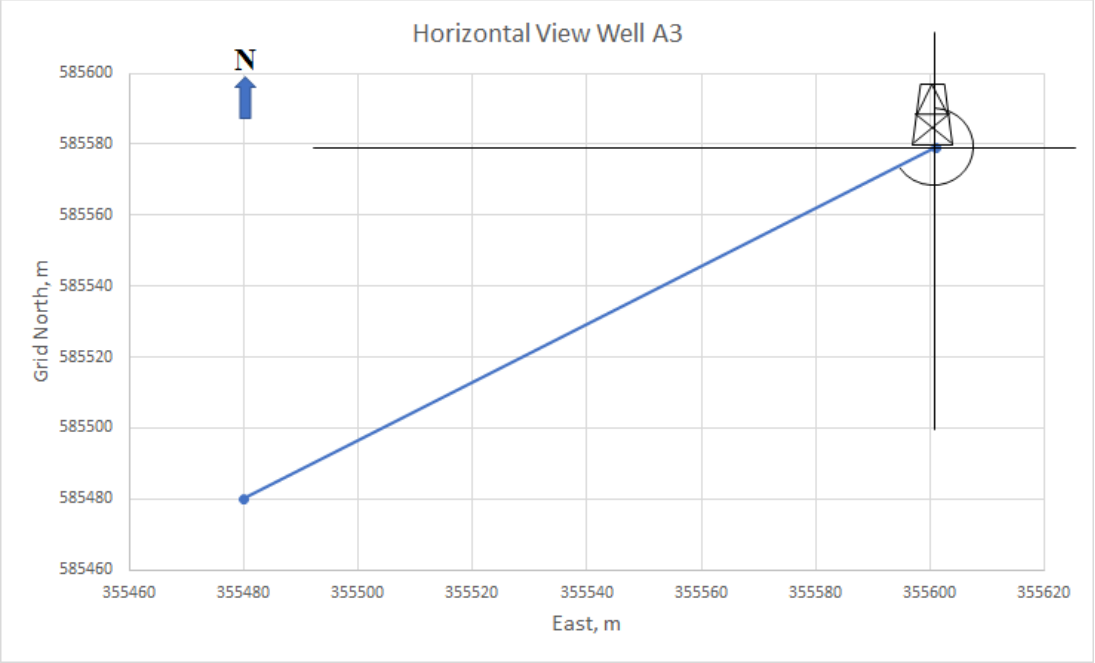

Figure 6. Horizontal View Well A3

Table 4
Parameter of Well Profile A3

Section	Drilling Trajectory	Bit Size	OD Casing	Length Casing	BUR	MD (ft)	TVD (ft)	H (ft)	θ
Vertical Section (0-300 ft)	Conductor Casing (0-100 ft)	26”	20”	100 ft	0º	100	100	0	0º
	Surface Casing (100-300ft)	17½”	13⅜”	300 ft	0º	200	300	0	0º
Build Up Section (300 – 560 ftMD)	Intermediate Casing 300 –560 ftMD	12¼”	9⅝”	560 ft	6º /100 ft	260	557	35	N219ºE
Tangential (557 –2577 ftMD)	Production Casing 560–2577 ftMD	8½”	7”	2577 ft	0º	2017	2500	512	N219ºE

4. Well Profile A4

The A4 well is a J-Shaped directional drilling well with a target depth of 2500 ftTVD/2577 ftMD with a KOP of 300 ftTVD/MD. The A4 well profile will consist of 3 sections, namely, a vertical section at a depth of 0-300 ft, a build up section at a depth of 300-560 ftMD, and a Tangential section at a depth of 560-2577 ftMD. The vertical section consists of 2 drilling routes, namely the conductor casing route using a 20” OD casing at a depth of 0-100 ft and a surface casing route using a 13⅜” OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-560 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 560-2577 ftMD. In the A4 well, the azimuth direction is N323ºE with a maximum inclination angle of 31º.

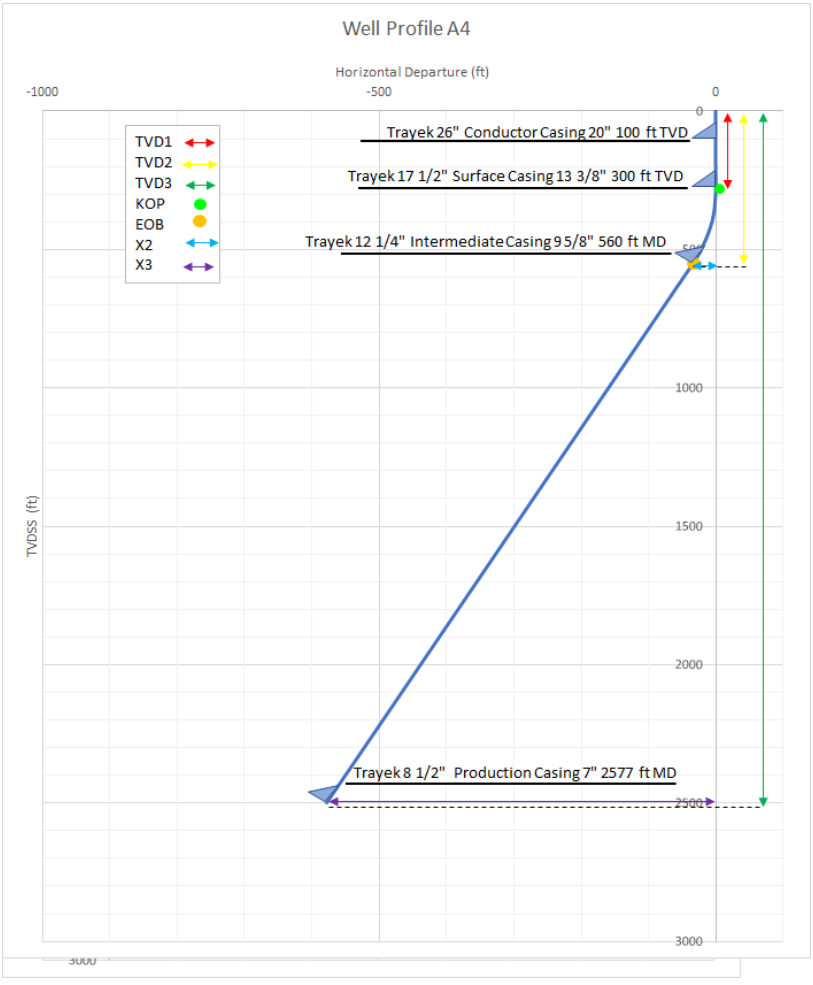

Figure 7. Well Profile A4

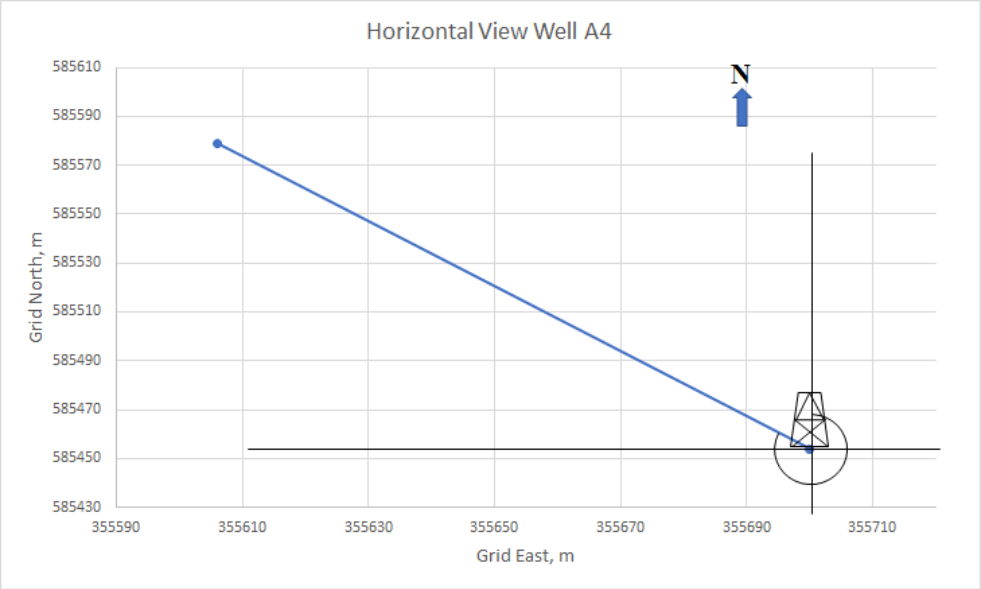

Figure 8. Horizontal View Well A4

Table 5
Parameter of Well Profile A4

Section	Drilling Trajectory	Bit Size	OD Casing	Length Casing	BUR	MD (ft)	TVD (ft)	H (ft)	θ
Vertical Section (0-300 ft)	Conductor Casing (0-100 ft)	26”	20”	100 ft	0º	100	100	0	0º
	Surface Casing (100-300ft)	17½”	13⅜”	300 ft	0º	200	300	0	0º
Build Up Section (300 – 560 ftMD)	Intermediate Casing 300 –557 ftMD	12¼”	9⅝”	557 ft	6º /100 ft	260	557	35	N323ºE
Tangential (557 –2577 ftMD)	Production Casing 557–2577 ftMD	8½”	7”	2577 ft	0º	2017	2500	512	N323ºE

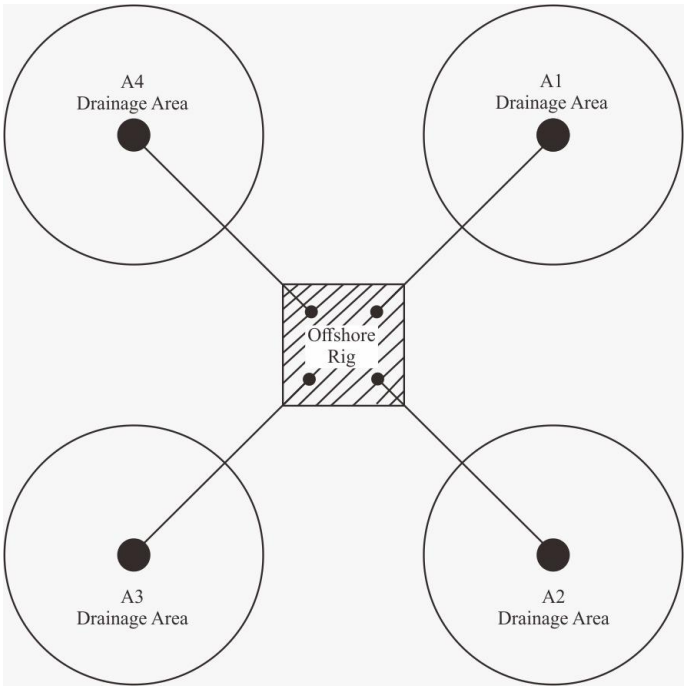

Fig. 9. Direction and Position Well in Platform

This drilling plan is carried out using a cluster system with 4 directions which functions to be able to obtain the maximum drain area as shown in Figure 9, where each drilling target is carried out.

VI. Conclusion

Based on the results of the research and discussion that have been presented, the following conclusions can be drawn:

1. Drilling planning is carried out with different cardinal directions to maximize the drain area in the reservoir.
2. Well A1 in the vertical section consists of 2 drilling routes, namely the conductor casing route using a 20" OD casing at a depth of 0-100 ft & a surface casing route using a 13⅜" OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-560 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 560-2557 ftMD. In the A1 well, the azimuth direction is N53^{o}E with a maximum inclination angle of 31^{o}.
3. Well A2 in the vertical section consists of 2 drilling routes, namely the conductor casing route using a 20" OD casing at a depth of 0-100 ft & a surface casing route using a 13⅜" OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-557 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 557-2575 ftMD. In well A2, the azimuth direction is N162^{o}E with a maximum inclination angle of 31^{o}.
4. The A3 well in the vertical section consists of 2 drilling routes, namely the conductor casing route using a 20" OD casing at a depth of 0-100 ft & a surface casing route using a 13⅜" OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-560 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 560-2577 ftMD. In the A3 well, the azimuth direction is N219^{o}E with a maximum inclination angle of 31^{o}.
5. The A4 well in the vertical section consists of 2 drilling routes, namely the conductor casing route using a 20" OD casing at a depth of 0-100 ft & a surface casing route using a 13⅜" OD casing at a depth of 100-300 ft. Furthermore, the build up section consists of 1 route, namely the intermediate casing route using a 9⅝" OD casing at a depth of 300-557 ftMD. And the tangential section has 1 route, namely the production casing route using a 7" OD casing at a depth of 557-2577 ftMD. In the A4 well, the azimuth direction is N323^{o}E with a maximum inclination angle of 31^{o}.

VII. Acknowledgement

Thank you to LPPM UPN Veteran Yogyakarta for the international basic research grant assistance

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